Mineral Development in Ontario North of 50°

Technical Paper #1

The Undiscovered Mineral Potential of Ontario North of 50°

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and
Prof. O. T. Djamgouz

the ROYAL COMMISSION on the NORTHERN ENVIRONMENT

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This technical report provides background material for the final report Mineral Development in Ontario North of 50°, submitted to the Royal Commission on the Northern Environment by Laurentian University in September, 1982.

However, no opinions, positions or recommendations expressed herein should be attributed to the Commission; they are solely those of the authors.

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Introduction

The evaluation of the mineral endowment of a vast region such as that of Northern Ontario is a complex undertaking. The exploration data is sparse and when available there is general reluctance on the part of the mining companies privy to this data to release such information. However, since no dependable exploration data is available alternative approaches are needed in order to quantify the mineral potential of the study area.

One technique employed by Harris (1965) uses multivariate analysis where relationships are established between some geological characteristics and the known resources of a well explored and developed region which bears geological resemblance to the unexplored area. The area with the known resources is used as a 'control area' to estimate the probability of occurrence of mineral resources in the unexplored area.

A second method is to pool the opinions of experienced geologists who are familiar with the study area or with geologically similar areas. The judgement of each respondent in the form of subjective probabilities

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is analyzed and aggregated with the other responses to arrive at a collective picture of the mineral endowment.

The approach used in this study employs opinion polls patterned on a study done in 1970 for northern British Columbia and Yukon Territory by Barry and Freyman. In these polls the geologists interviewed gave their opinions in the form of probabilities of occurrence of the type of commodity, the number of deposits, and the grade and tonnage of these deposits.

Due to resource and time limitations, it was not possible to conduct a Delphi Style evaluation which would have yielded more reliable data and conclusions; the Delphi method is described briefly later in this chapter for completeness.

The estimates of mineral potential and the most likely locations of mineral occurrences will be integrated into developing estimates of the probable reserves that could be obtainable should these deposits be discovered and developed. The projected estimates can form a basis for government policy and for exploration investment decisions by mining companies interested in developing the mineral endowment of Northern Ontario.

The Delphi Method

The Delphi method is a systematic procedure for the assessment of the existence, size, and grade of ore

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deposits based on subjective opinions of expert geologists. The Delphi method takes its name from the famous oracle of Delphi of ancient Greek mythology. A priestess, having bathed in the fountain of Castalia, eaten the leaves of the sacred laurel near the volcano, was thrown into a mystic trance. She uttered mystic words which were capable of being interpreted in various ways. However, there is very little that is oracular about the technique as it is used today.

In the pure Delphi technique the process involves an iterative controlled feedback of the individual expert responses in order to improve the group estimates. Although the method is applicable in a large number of situations, it is most useful when the data is very sparse. The desirability of the Delphi technique appears to be inversely proportional to the density of available data. Consequently, the method is most suitable to regional or reconnaissance type assessments.

Fig. 1 shows a block diagram for a pure Delphi procedure. When the data is obtained strictly in accord will all the steps of the Delphi method the costs in time and resources are likely to be very high, but so are the rewards.

Earlier Studies

Past studies with respect to the evaluation of the undiscovered mineral potential of Northern Ontario have

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all been of a qualitative nature. The Department of Energy, Mines and Resources, Ottawa, in 1975 published the results of their Mineral Area Study (MAPS) project. This study covered the individual provinces of Canada including Ontario, and delineated sub-areas that are likely to be centres of mineral development over the next 20-25 years.

At the Ontario Geological Survey, there is an on-going programme of compiling and publishing maps of the mineral potential of parts of Ontario. These maps have been produced in consultation with concerned geologists and geophysicists. The maps indicate on a scale of 7, but more generally in three graphs, the relative mineral potential of individual regions. An accompanying bibliography of the published work on the region that each map represents is an important feature of these maps. However, it must be emphasized that estimates are all qualitative.

Regional Geology

The study region to a large extent forms a part of the Superior Province of the Canadian Shield. The post-pre-cambrian sedimentary areas are associated with potential lignite deposits.

The oldest rocks of the Superior Province are volcanic and sedimentary rocks of the Archaean age.

These occur as a series of almost east-west belts across the province. The sedimentation and volcanism may have taken place simultaneously in different parts of geosynclines or there may be a transition from volcanism to sedimentation. While in well studied parts of Ontario, estimates of the thicknesses of Archaean complexes have been made which range from a maximum of 7,500 m to almost twice as much - such figures are not available.

The Archaean rocks on the Superior Province have been affected by the Kenoran Orogeny (about 2,500 million years ago); the orogeny involved a series of interacting complex events that included folding, shearing, metamorphism and the intrusion of granitic rocks of various compositions. Granit gneisses, at palces highly metamorphosed have resulted from the granitic rocks include granochiorite, quarts diorite and morgonite, while the volcanic rocks include the calcalkaline assemblages of basalt, andesite, dacite and rhyolite. At places, the study region has been faulted and intruded by dykes, however, detailed geological study are still required to be able to make a comprehensive picture of the causes and consequences.

<u>The Data Base</u>

The data base for this study has been developed by first dividing the study area into a set of 136 subareas or cells. Each cell is bounded by one degree of

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longitude and half a degree in latitude. However, a number of cells on the fringes of the study region do not conform to the precise measurements of $1^{\circ} \times 1/2^{\circ}$. This should not make any difference in the subjective evaluation procedure because the geologists concerned will intuitively 'weight' their estimates by observing any changes in the areas of the cells.

For conducting the Monte Carlo simulation, the study area was divided into ten geological regions, as shown in Table 1, and Fig. 2. There are several methods of asking probability questions. The three most commonly used method are:

1. Direct probabilities pre-specified size intervals
2. Fractile method
3. Functional forms (probability distributions) of intervals.

For this study the first method was used.

The Questionnaire

The questionnaire used for recording the assessments given by the respondents is shown in Fig. 3. Basically, the respondents were asked to supply for each cell quantitative responses according to their best judgement to the following questions:

1. What is the most likely distribution of the deposits for the mineral categories in the

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questionnaire?

2. What is the most likely tonnage and grade for each mineral category and the probability of its occurrence?

3. What is the probability of developing the mineral category in the cell under consideration for the next 25 years?

The Computation Technique

The cost of gathering the data and the limited amount of time available to the participating geologists and the monitor (Research Supervisor of the Project) resulted in somewhat reducing the quality and quantity of data that was decided desirable for obtaining probability distributions to be used in the assessment of the mineral potential of the area of the study using the Monte Carlo simulation approach. Nevertheless, the results will be of great usefulness for this assessment.

The computation technique which is similar to that used in references 2 and 5, is summarized below:

1. The total number of mineral deposits in the cell:

$$M = \sum_{i=1}^{Nd} (pi/p)\ mi$$

2. The number of deposits of commodity j in the cell:

$$N^j = (q_j/Q)\ M$$

3. Average size (tonnage) of deposit of commodity j:

$$T^j = \sum_{K=1}^{Nt} \left(\left(\sum_{L=1}^{N_g} r^j_{kL}/R^j \right) t^j_k \right)$$

4. Average grade of deposit of commodity j:

$$G^j = \sum_{K=1}^{Nt} \left(\sum_{L=1}^{Ng} r^j_{kL} \; g^j_L / R^j \right)$$

5. The total metal content of commodity j in the cell:

$$C^j = N^j \; T^j \; G^j$$

Where:

i = Size (number) category for total No. of deposits

j = Commodity category

k = Size category (tonnage) for each commodity

L = Size category (grade) for each commodity

pi = Prob. index of total number of deposits

q_j = Prob. index of the distribution of commodity category (deposits)

r^j_{kL} = Joint prob. index of average tonnage and grade of commodity j

N_g = No. of grade intervals

N_t = No. of tonnage intervals

N_m = No. of commodities

N_d = No. of intervals for total number of deposits

$$P = \sum_{i=1}^{Nd} /Pi$$

$$Q = \sum_{j=1}^{Nm} q_j$$

$$R^j \sum_{k=1}^{N} \sum_{L=1}^{Ng} r^j_{KL}$$

m_i = mid points of the classes in the number of deposits

t^j_k = mid points of tonnage classes of commodity j

g^j_L = mid points of grade classes of commodity j

The following probability distribution can be obtained:

1. A probability distribution that describes the probability of 1, 2, --, n deposits can be computed from the data on the number of deposits. In the simulation analysis this distribution is sampled to determine how many deposits there are in the cell. (This data was not available in this study).

2. A probability distribution describing the probability that a deposit would be of a particular commodity type (Cu-Pb-Zn, etc.) can be computed from the number in the boxes (in the upper left hand corner) of the tonnage-grade blocks. Thus, if one of the simulation iterations the cell was found to contain four deposits, this distribution is sampled four times to see how many of these were Cu, Pb-Zn, Mo, etc.).

3. A marginal probability distribution for tonnage

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for each commodity type and a conditional distribution for grade (conditional on the tonnage category) can be computed from the tonnage-grade distributions. Thus, having found that there is a copper deposit, the marginal distributions on tonnage is sampled to assign a tonnage to the deposit. Then the distribution of grade conditional upon the occurrence of this tonnage is sampled to give a grade. Unfortunately, the amount of data available in this study is not adequate to generate some of the above distributions.

COMMODITIES INVESTIGATED

Sixteen Commodities

Sixteen commodities were investigated in this study. There was a seventeenth category listed under 'other' on the questionnaire. The commodities are: copper, zinc, lead, nickel, molybdenum, uranium, gold, silver, iron, lithium and columbium, coal, chromium, diamond, cobalt, and platinum.

Some of these commodities occur together. The questionnaire grouped such commodities as separate categories. These combinations include Cu-Zn, Pb-Zn, Ni-Cu and Cu-pb-Zn. Gold and Silver which may occur together were treated as separate categories.

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Although commodities such as coal and diamond were included in the study, no attempt was made to analyze and process them in the same rigorous manner as was done for the other metallic commodities.

Tonnage and Grade Classifications

The tonnage of ore considered in this study ranged from 0.5 to 200 million tons and was divided into seven intervals as follows: 0.5-1; 1-5; 5-10; 10-25; 25-50; 50-100; 100-200 million tons. A deposit larger than 200 million tons was divided into several deposits of 200 millions or less.

Three grade categories were used in this study: low, medium, and high grade. Table 2 shows the grade classifications for the commodities studied.

TABLE 2: COMMODITY GRADE INTERVALS

		Low	Average	High
Cu	(%)	0.5-1.0	1.0-3.0	3.0-6.0
Zn-Cu	(%)	0.5-1.0	1.0-3.0	3.0-6.0
Pb-Zn-Cu	(%)	2.0-4.0	4.0-8.0	8.0-16.0
Pb-Zn	(%)	2.0-4.0	4.0-8.0	8.0-16.0
Ni-Cu	(%)	0.4-0.6	0.6-2.6	2.6-4.0
Mo	(%)	0.2-0.5	0.5-1.0	1.0-2.0
U	(Lb/ton)	1.5-2.0	2.0-4.0	4.0-10.0
Au	(oz/ton)	0.1-0.15	0.15-0.25	0.25-0.35
Ag	(oz/ton)	1.0-3.0	3.0-6.0	6.0-10.0
Fe	(%)	20.0-25.0	25.0-30.0	30.0-35.0
Li-Col	(%)	1.0-2.0	2.0-3.0	3.0-4.0
Coal	(%)	15.0-25.0	25.0-35.0	35.0-50.0
Diam	($/ton)	5.0-15.0	15.0-25.0	25.0-35.0
Cr_2O_5	($/ton)	5.0-15.0	15.0-25.0	25.0-35.0
Co	(%)	1.0-2.0	2.0-3.0	3.0-4.0
Plat	(Oz/ton)	0.1-0.15	0.15-0.25	0.25-0.35
Other	(%)	0.2-05	0.5-2.0	2.0-3.0

THE INTERVIEW PROCESS

Twenty geologists were interviewed during the summer of 1980. Thirteen of these geologists were associated with Toronto-based mining and exploration companies; five were resident geologists with the Geological Survey of Ontario and two geologists were based in Sault Ste. Marie and representing a mining company.

At the beginning of an interview each geologist was given time to familiarize himself with the study area and the cell system of the map north of the 50th parallel. Each respondent was then asked to give his response to the following:

1. In your opinion, what would be the size of a mineral reserve of ore, assuming its technical/economical viability, for the various commodities listed in the questionnaire and for each cell shown on the map.

2. Express your level of confidence in the estimate made by assigning it a probability on a scale from zero to ten, in which zero implies an impossibility and ten implies absolute certainty.

3. In your opinion, what would be the most likely grade of the reserve chosen by you for each commodity.

4. What is the probability of bringing the ore deposit

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into production in the next 25 years.

The answers were coded by the interviewer on the specially prepared data sheets for later inputting into the computer (see Fig. 3).

Difficulties Encountered and Their Implications

During the interviews the following observations were made:

1. Some geologists stated clearly that they did not believe in this type of data gathering and that they were pessimistic about the usefulness of the results.

2. The majority of the respondents gave their most pessimistic assessment of the potential of the area in the form of marginal grades and small ore deposits. This pessimistic characteristic of geologists appears to have been observed by other researchers (Ref. 2) and corroborated by comparing geologists' responses for 'well known cells' and 'very poorly known' cells. Geologists tend to give conservative estimates for unexplored areas.

3. Some of the geologists indicated that their lack of familiarity with the study area would affect the reliability of their responses.

4. Because of the orientation and the objectives of their companies, some of the geologists were willing

to give responses to only a limited number of commodities. For example, the majority of the geologists were interested in gold only, while others had interest only in iron.

5. Few of the respondents tended to be secretive and reluctant to share their knowledge. Their responses tended to be very pessimistic. However, the majority were frank, cooperative, and volunteered substantial information.

Specific Opinions Given by the Respondents

1. The majority of the geologists indicated that the existence of the 'access roads' would markedly increase the number of findings, since the small size exploration companies or individual prospectors would then spend their valuable capital on prospecting rather than on road development.

2. The presence of access roads enhances the interest in an area and reduces the burden of the transportation of materials and equipment.

3. Few large mining companies stated that access roads to the area were not important as they could fly their exploration crews easily to a specific location. However, once findings prove to be economical, they believe that the government would help to build the required roads.

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4. Few geologists indicated that in order to make proper decisions in selecting appropriate areas for exploration, more detailed geological maps were necessary. This is because knowledge of the mine geology of the known mining areas could give the required clue for new discoveries.

5. One respondent stated that base metal discoveries of sedimentary origin could become possible as the present knowledge of the existing mine geology of this type of deposit improves.

Conclusions

The following conclusions were arrived at based on the interviews conducted with the twenty geologists:

1. The majority of the prospecting activity is likely to continue to be in the existing mining camp areas.

2. Possible gold deposit discoveries are likely to be small with tonnage ranging from 0.5 to 1.0 million tons at a grade of 0.25 oz/ton. However, higher gold prices could transform these occurrences into profitable deposits. Additionally, since the end product is small in quantity but high in value, air freight could prove to be economical and there may not be a need for developing railroads or highways.

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3. Base metal deposits are likely to be small in size with tonnage ranging from 1 to 5 million tons with a combined marginal grade of 4 to 6%.

4. Uranium occurrences will be of poor grade (1 to 2.5 lb/ton). Due to Saskatchewan's rich uranium discoveries, the likelihood of developing these deposits in the next 25 years is very small.

5. Although iron occurrences are vey substantial, specially in the lake St. Joseph region with a total mineralized zone of 1.5 billion tons, the grade is marginal and ranges from 20 to 32%. Since the capital requirements is 'astronomically' high, availability of the required capital is a key issue in the decision making process relative to the development of this area. However, a joint venture by a consortium of large steel producers such as STELCO, DOFASCO, and ALGOMA STEEL could be a feasible alternative. Additionally, because of existing long-term contracts between the Canadian Steel companies and U. S. iron concentrate suppliers, the Canadian ore bodies would not be needed immediately and their development could be delayed for at least 15 to 20 years.

6. The nickel deposits in the Trout Lake region could be economical in 20 years from now.

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7. Although the average annual exploration budgets ranged from $100,000 to $250,000 the general con- census was that a minimum budget of the order of $5 million will be needed to locate an economical base metal ore-body. For an economic iron ore-body the explorations budget should be in the $7 to $10 million range.

8. The findings of this study compare favourably with the Ontario mineral potential maps. This, in part, may be due to the fact that the respondents may have based some of their responses on their know- ledge of the above mentioned maps.

SUMMARY OF GENERAL DISTRIBUTION OF MINERALS AND THEIR PLACE VALUES

The general distribution of mineral occurrences in the study area are briefly discussed. Their total metal content and place values are given. Probabilities of existence and development of the mineral occurrences are also indicated. The average grades and metal content of the mineral occurrences in each cell are shown in Figs. 4A-20A. The net values and the corresponding internal rates of return are shown in Figs. 4B - 20B.

The overall in-place value of the minerals of the study area was calculated to be $245.918 billion.

1. Copper

According to our findings, copper mineralization is mainly distributed in blocks I, II, III, and IV and some other occurrences are detected in blocks V, VII, and X.

The total metal content of the area is: 0.893 million tons of copper.

The total place value of the copper is: $1.648 billion.

Probability of the occurrence of the reserves varied between 10% and 60%.

Probability of the development of the mineral occurrences

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into a mine: Remote areas: 0 to 20%

Accessible areas: 20 to 75%

2. Copper - Zinc

Copper - Zinc mineralization is mainly distributed in blocks I, II, and III and some other occurrences are observed in blocks IV, V, VI, and VII.

The total metal content of the area is: 7.329 million tons of Cu-Zn.

The total place value of the Cu-Zn is: $8.156 billion.

Probability of the occurrence of the reserves varied between 20% and 50%.

Probability of the development of the mineral occurrences into a mine: Remote areas: 2 to 5%

Accessible areas: 10 to 75%

3. Base Metals (Pb-Zn-Cu)

Lead, Zinc and Copper mineralization is practically expected to exist in almost every cell with the exception of cells in the North east lowlands. Scattered distribution is concentrated in blocks IV, VII, VIII, and X.

The total metal content of the area is: 33.430 million tons of Pb-Zn-Cu.

The total place value of the Pb-Zn-Cu is: $32.100 billion.

Probability of development of the mineral occurrences into a mine: Remote areas: No chance

Accessible areas: 25 to 100%

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<u>4. Lead - Zinc</u>

Lead - Zinc mineralization is mainly distributed in blocks III, IV, and X and an occurrence in cell 1021, block II.

<u>The total metal content of the area is</u>: 33.262 million tons of Pb - Zn.

<u>The total place value of the Pb - Zn</u>: $29.916 billion.

Probability of the occurrence of the reserves varied between 25% and 50%.

Probability of development of the mineral occurrences into a mine: Remote areas: 0 to 10%

Accessible areas: 50 to 100%

<u>5. Nickel - Copper</u>

The Nickel - Copper mineralization is mainly distributed in blocks I, II, III, and VII and cell 1093, block VI.

<u>The total metal content of the area is</u>: 4.001 million. tons of Ni-Cu.

<u>The total place value of the Ni-Cu:</u> $16.949 billion.

Probability of development of the mineral occurrences into a mine: Remote areas: 0 to 10%

Accessible areas: 20 to 60%

<u>6. Molybdenum</u>

The Molybdenum mineralization occurs in cell 1035, block I; cell 1036, block II; cells 1015 and 1031, block V; and cell 1070, block VI.

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The total metal content of the area is: 0.097 million tons of Moly.

The total place value of the Molybdenum: $1.188 billion.

Probability of the occurrence of the reserves varied between 5% and 15%.

Probability of development of the mineral occurrences into a mine: Remote areas: 0 to 2%

Accessible areas: 2 to 20%

7. Uranium

Uranium mineralizations are scattered in blocks I, II, III, V, VI, VII, IX, and X.

The total yellow cake content of the area is: 599.5 million lbs.

Total place value of the Uranium: $25.521 billion.

Probability of the occurrence of the reserves varied between 10% and 75%.

Probability of development: Remote areas: 0 to 15%

Accessible areas: 0 to 70%

8. Gold

Gold mineralization occurs in blocks I, II, III, VI, VII, VIII, and IX; and cells 1015, 1016, 1031 of block V; and cell 1126 of block X.

The total metal content of the area is: 36.675 million ounces.

The total place value of the Gold is: $11.263 billion.

Probability of the occurrence of the reserves varied ../

between 20% and 80%.

Probability of development: Remote areas: 20 to 30%

Accessible areas: 30 to 100%

9. Silver

Silver mineralization is scattered in blocks I, II, III, V, VI, VII, and IX.

The total metal content of the area is: 849.8 millions ounces of silver.

The total place value of the Silver is: $9.424 billion.

Probability of development: Remote areas: 30 to 80%

Accessible areas: 35 to 100%

10. Iron

Iron occurrences are distributed in blocks I, II, III, and VI.

The total metal content of the area is: 1.223 billion tons of Fe.

The total place value of the Iron is: $76.861 billion.

Probability of the occurrence of the reserves varied between 70% and 100%.

Probability of development: Remote areas: 0 to 20%

Accessible areas: 10 to 90%

11. Lithium-Columbium

Li-Cb mineralization is scattered in blocks I, II, III, V, VI, VII, and IX.

The total metal content of the area is: 2.508 million

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tons of Li-Cb.

<u>The total place value of the Li-Cb is</u>: $13.735 billion.

Probability of the occurrence of the reserves varied between 10% and 75%.

Probability of development: Remote areas: 0 to 15%

Accessible areas: 15 to 60%

<u>12. Coal</u>

Coal occurrences are mainly in the southern parts of blocks IV and V.

<u>The total Coal content of the area is</u>: 155.725 million tons.

<u>The total place value of the Coal is</u>: $6.229 billion.

Probability of the occurrence of the reserves varied between 80% and 100%.

Probability of development: 60 to 100%

<u>13. Chromium</u>

Chromium occurrences are shown in cell 1001 of block and cell 1108 of block VII.

<u>The total metal content of the area is:</u> 4.87 million

<u>The total place value of the Chromium is</u>: $31.11 billion.

Probability of the occurrence of the reserves varied between 10% and 65%.

Probability of development: Remote areas: 0 to 2%

Accessible areas: 0 to 2%

<u>14. Diamond</u>

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Diamond mainly occurs in blocks IV and V.

The total place value of Diamond is: $3.698 billion.

Probability of the occurrence of the reserves varied between 50% and 80%.

Probability of development: 70%

15. Cobalt

Cobalt occurrence was reported only in cell 1001 of block I.

The total Cobalt content of the area is: 45 thousand tons.

The total place value of the Cobalt is: $2.212 billion.

Probability of the occurrence of the reserve is: 30%

Probability of development is: 20%

16. Platinum

Mineralization of Platinum was reported to occur in cell 1055 of block III and cell 1108 of block VII.

The total platinum content of the area is: 9.975 million ounces.

The total place value of the Platinum is: $3.514 billion.

Probability of the occurrence of the reserve: 35 to 50%

Probability of development: 2 to 30%.

SUMMARY OF NET VALUES OF MINERALS AND THE CORRESPONDING PROFITABILITY

In this section only prominent minerals which would indicate at least a 15 percent rate of return will be ../

discussed. All of the net values and internal rates of return are shown in Figs. 4b-20b.

Copper - Zinc

The profitability calculations indicated 15.09% internal rate of return for 16,000 tons per day production with a net value of $353 million in cell 1034. Using 1979 metal prices all of the other mineral occurrences prove to be uneconomical. Average combined grade is 4.5%.

Base Metal Pb-Zn-Cu

In cells 1053, 1118, and 1127 the net values were $251, $277, and $251 million respectively. The most economical production rate is calculated to be 2,000 tons per day with an internal rate of return of 22%. Combined average grade is 12% Pb-Zn-Cu. However, because of the remoteness of the locations of cells 1118 and 1127 the likelihood of development of the deposits in these areas is very small. In cells 1031, 1034, and 1041 the net values were $200, $480, and $365 million respectively. In cell 1031 the most economical production rate is 4,000 tons per day with a 17.2% internal rate of return; in cell 1034, 8,000 tons per day with a 23.5% internal rate of return, and in cell 1041, 8,000 tons per day with a 19.6% internal rate of return with combined average grades of 9 to 10%.

Lead - Zinc

The majority of the cells in blocks III and IV ../

have indicated net values between $420 and $471 million ranging from 22% to 25.4% internal rate of return at 8,000 tons per day production. However, if it is feasible to operate the mine at 16,000 tons per day by open pit method, the internal rate of return would increase to 26.6% which is not a significant increase. Combined average grade is 12%.

Uranium

The Uranium net values and maximum profitability at appropriate production rates are shown in the following table:

CELL No.	NET VALUE (Million Dollars)	IRR (%)	PRODUCTION RATE (Tons/Day)
1006	$ 636	5.4%	8,000
1007	134	21.0	1.000
1017	1,833	21.0	16,000
1036	1,266	65.0	8,000
1079	215	15.7	1,000
1083	305	18.2	8,000
1084	305	18.2	8,000
1097	305	18.2	8,000
1114	385	22.2	8,000
1115	385	22.2	8,000
1118	305	18.2	8,000
1124	385	22.2	8,000
1125	385	22.2	8,000
1127	305	18.2	8,000

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In all cases accessibility is a problem and as long as Saskatchewan's high grade uranium deposits are in production or until there will be an upward change in demand and prices, these deposits are not likely to be discovered or developed into mines.

Gold

Because of marginal ore grades and the small size of the deposits all of the mineral occurrences proved to be uneconomical at 1979 prices with the exception of cell 1016. The net value in this cell is $508 million with an internal rate of return of 19.9% at 2,000 tons per day production rate.

Lithium and Columbium

The Li-Cb values and maximum profitability at appropriate production rates are shown in the following table:

CELL NO.	NET VALUE (Million Dollars)	IRR (%)	PRODUCTION RATE (Tons/Day)
1007	$ 165	40.0	1,000
1014	2,345	111.0	8,000
1019	103	19.0	1,000
1020	181	25.0	2,000
1047	2,350	39.2	8,000
1055	241	28.8	4,000
1083	632	49.4	8,000
1084	1,252	65.2	8,000

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CELL No.	NET VALUE (Million Dollars)	IRR (%)	PRODUCTION RATE (Tons/Day)
1097	$1,252	65.2	8,000
1118	1,252	65.2	8,000
1127	1,252	65.2	8,000

In this case also only mineral occurrences in accessible areas have a chance of being developed.

Cobalt

Cobalt occurs only in cell 1001. The net calculated value is $1,208 million with an internal rate of return of 150% at 2,000 tons per day.

SUMMARY OF ORE DEPOSITS ACCORDING TO THEIR DISTRIBUTION IN BLOCKS AND THEIR PROFITABILITY

The study area has been divided into 10 blocks and the profitability of each block has been calculated. The cell distributions in the blocks are shown in the attached map. Map

Block I

Table 3 shows that in this block there are 80 ore deposits and a total ore tonnage of 750.42 million tons. The place value of this tonnage is $27.92 billion. The most prominent minerals of this block are Cobalt, Lithium-Colombium, Base Metals: Cu-Pb-Zn, Copper-Zinc, and Uranium. The net values, internal rates of return and the corresponding production rates are shown in Fig. 21. ../

Lithium-Colombium

In block I, there are 8 deposits of Li-Cb, each having 870 thousand tons of ore at an average 1.5% grade. The place value is $1.075 billion.

Cobalt

There is only one Cobalt deposit with 3 million tons of ore reserve at 1.5% grade. The place value is $2.212 billion.

Base Metals Cu-Pb-Zn

These are 16 small deposits each having 3.5 million tons of ore reserves with an average combined grade of 7.8%. The place value is $4.147 billion.

Copper - Zinc

There are 11 small deposits each having 4.5 million tons of ore reserves with an average combined grade at 4.1%. The place value is $2.347 billion.

Uranium

There are two Uranium deposits each having 39 million tons of ore reserves with an average grade of 1.75 lb/ton.

Block II

Table 4 indicates that there are 71 ore deposits and the total ore reserves of this block is 2,436.2 million tons. The place value of these ore deposits was calculated to be $56.07 billion.

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of this block are Uranium
-Zn-Cu, and Nickel-Copper.
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in Fig. 22.

osit with 17.5 million
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ving an average of 4.41
a combined average grade
billion.

having an average 10.5
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ls in this block is

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The most prominent minerals of this block are Copper-Zinc, Base Metals (Pb-Zn-Cu), Lead-Zinc, Nickel-Copper, and Gold. Lithium-Colombium, and Uranium deposits are also profitable. The net values, internal rates of return and the appropriate production rates are shown in Fig. 23.

Copper - Zinc

There are 12 small ore deposits each having 4.53 million tons of ore with a combined grade of 3.3%. The place value is $1.934 billion.

Base Metals (Pb-Zn-Cu)

There are 16 small deposits each having 5.41 million tons of ore with a combined grade of 8.3%. The place value is $6.924 billion.

Lead - Zinc

There are 6 average size ore deposits each having 14.7 million tons of ore with a combined average grade of 11.9% The place value is $9.464 billion.

Nickel - Copper

There are 5 average size ore deposits each having 10.55 million tons of ore at a combined average grade of 1.6%. The place value is $3.575 billion.

Gold

There are 19 small ore deposits each having 1.53

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million tons of ore at an average grade of 0.23 oz per ton. The place value is $2.112 billion.

Block IV

The total number of ore deposits is 31 and there are 416.17 million tons of ore. The total place value of the metals in this block is $22.32 billion (See Table 6).

The most prominent minerals of this block are Base Metals (Pb-Zn-Cu) and Lead-Zinc. The net values, internal rates of return, and corresponding production rates are shown in Fig. 24.

Base Metals (Pb-Zn-Cu)

There are 8 small ore deposits each having 2.94 million tons of ore with a combined grade of 9.7%. The place value is $2.195 billion.

Lead - Zinc

There are 15 small ore deposits each having 9.12 million tons of ore with a combined average grade of 12%. The place value is $14.772 billion.

Block V

In Block V, there is a total of 40 ore deposits with 550.05 million tons. The place value of these metals is $26.18 billion (See Table 7).

The most prominent minerals of this block are Lithium-Colombium, Base Metals (Pb-Zn-Cu), and Gold. ../

Uranium and Lead-Zinc are marginal deposits. The net values, internal rates of return and the corresponding daily production rates are shown in Fig. 25.

Lithium - Colombium

There are 2 large ore deposits each having 27.5 tons of ore with a grade of 1.8%. The place value is $10.94 billion.

Base Metals (Pb-Zn-Cu)

There are 11 small ore deposits each having 2.84 million tons of ore at a combined average grade of 10.4%. The place value is $2.984 billion.

Gold

There are 4 average size ore deposits each having 8.91 million tons of ore with an average grade of 0.22 oz per ton. The place value is $2.426 billion.

Block VI

In block VI there are 56 ore deposits. Total tonnage is 1243.29 million tons with a place value of $29.34 billion (See Table 8).

The most prominent minerals of this block are Uranium and Base Metals (Pb-Zn-Cu). Lithium-Colombium are marginal deposits. The net values, internal rates of return, and the corresponding production rates are shown in Fig. 26.

Uranium

There are 4 small ore deposits each having 4.02 ../

million tons of ore with a grade of 2.12 lb/ton. The place value is $1.333 billion.

Base Metals (Pb-Zn-Cu)

There are 12 small ore deposits each having 3.62 million tons of ore with a combined average grade of 6.3%. The place is $2.502 billion.

Gold

There are 11 gold deposits; however, because of their small size, they are not shown as they are not economical.

Block VII

In this block, there is a total of 54 ore deposits with a tonnage of 409.60 million tons. The place value of the minerals is $27.60 billion (See Table 9).

The most prominent minerals are Lithium-Colombium, Uranium and Base Metals. Nickel-Copper and Platinum are marginal. There are 17 very small gold deposits; however, due to their small size and low grade, they are not economical to mine. Other profitability characteristies are shown in Fig. 27.

Lithium-Colombium

There are 7 small ore deposits each having 6.73 million tons of ore with a grade of 1.5%. The place value is $7.733 billion.

Uranium

There are 3 average size ore deposits each having 17.5 million tons of ore with a grade of 1.75 lb/ton. The place value is $3.911 billion.

Base Metals (Pb-Zn-Cu)

There are 12 small size ore deposits each having 4.95 million tons with a combined average grade of 6%. The place value is $3.450 billion.

Block VIII

In this block, there are only 14 ore deposits with a total tonnage of 29.63 million tons. The place value of the minerals is $2.47 billion (See Table 10).

The most prominent mineral is Base Metals (Pb-Zn-Cu). Again, gold has 8 uneconomical small deposits. For economic details see Fig. 28.

Base Metals (Pb-Zn-Cu)

There are 8 small deposits each having 2.72 million tons of ore with a combined grade of 9.5%. The place value is $1.988 billion.

Block IX

In block IX there are 18 ore deposits with a total tonnage of 122.57 million tons. The place value is $13 billion (See Table 11)

The most prominent minerals are Lithium-Colombium, and Base Metals (Pb-Zn-Cu). Uranium has a marginal ../

profitability. For details see Fig 29.

Lithium - Colombium

There are 2 average size ore deposits each having 17.5 million tons of ore with an average grade of 1.5%. The place value is $5.743 billion.

Base Metals (Pb-Zn-Cu)

There are 8 small size ore deposits with a tonnage of 4.75 million tons each with a combined grade of 10.8%. The place value is $3.687 billion.

Block X

In this block, there is a total of 24 ore deposits. The total tonnage is 152.75 million tons with a place of $8.76 billion (See Table 12).

The most prominent mineral is Base Metals (Pb-Zn-Cu). There are eight economically marginal Uranium deposits. For economic details see Fig. 30.

Base Metals (Pb-Zn-Cu)

There are 2 small ore deposits with a tonnage of 3 million tons each at a combined grade of 12%. The place value is $0.691 billion.

NOTE: There are also 12 small very low grade and uneconomical Lead-Zinc deposits.

CONCLUSION

If in the future the metal prices increase at a faster

rate than the capital and operating costs, then some of the marginal deposits could become economical to develop; however, it is very unlikely that the mineral occurrences in the remote areas of the study area will be found or developed.

In the areas where mining activity already exists or is being established, the probability of finding ore deposits and developing new mines is very high.

MINING TAXATION IN CANADA

INTRODUCTION

Income from mining operations in Canada has long been subject to tax regulations that differ significantly from those imposed on income from other sources. Special mining taxes and royalties have been levied by Canadian provinces since the beginning of this century. These levies are in addition to the normal corporate taxes collected by both levels of government. Additionally, and from time to time, incentives and rules for computing the mining income for tax purposes.

Until the late 1960's tax regulations were relatively stable. This made it possible for the mining industry to introduce long term investment and development plans. However, in 1971 major incometax changes took place in Canada which resulted in many important incentives for the mining industry being reduced or totally eliminated. These include the termination of the three-year tax-exempt period for new mines, the replacement of automatic depletion by an earned depletion allowance and the non deductibility of provincial mining taxes. The latter resulted from the increase in provincial mining duties and royalties which were at the time deductible in calculating income for federal tax purposes. This provincial tax increase reduced the federal tax base and the federal government reacted by cancelling the deductibility.

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These changes when combined with a depressed metals market in the mid-1970's resulted in extremely high marginal rates and a greater tax burden on the mining industry.

In addition to their impact on the mining industry, rapid changes in tax regulations usually have a significant effect on the short and long-term government taxation revenues. Thus, greater understanding of the overall effects of tax changes on the mineral resource sector is of paramount importance for governments and legislators. Lack of understanding in this respect may result in one government department actively encouraging the development of mineral resources while another department administer tax laws which may deter such development with the net result that the goals of the two departments may be incompatible and unattainable.

Against this background, a special federal-provincial task force was established. In a report in the fall of 1978 this task force recommended more cooperation between Federal and Provincial authorities in coordinating their tax rules relating to the resource industry. This report may have been the catalyst for the introduction of more favourable tax rules by both the federal and provincial governments in 1978 and 1979.

Structure of Taxation of Mineral Resources

In addition to property, capital, sales, and other

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taxes' (not based on 'profit') mining profits are subject to a three-tier tax structure. These are the federal and provincial income taxes and the provincial mining taxes and royalties. Note that provincial taxes and royalties are no longer deductible for federal or provincial income tax purposes. Moreover, the provincial income tax is no longer deductible for federal tax purposes. The net result is that the total tax collected is the sum of the three separate levies.

Federal Tax

The major features of the federal tax provisions affecting the mineral resource sector are as follows:

1) Federal abatement
2) Investment tax credit
3) Capital cost allowance
4) Inventory allowance
5) Resource allowance
6) Earned depletion
7) Canadian development expense
8) Canadian exploration expense
9) Foreign exploration and development expense

Federal Tax Incentives

The federal government levies taxes on mining companies according to specified regulations under the Income Tax Act. At present this Act provides for several

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significant incentives to encourage exploration for mineral resources and the development of new mines or the expansion of existing mines. Some of the most important incentives are:

1) Immediate write-off of development and exploration costs.

2) Earned depletion of an additional $1 for every $3 spent on exploration, new mines, and other eligible expenses.

3) A deduction of 25% of income (before deducting interest expense and exploration and development expenditures).

4) Deduction of certain equipment costs on a 30% declining balance basis.

5) An immediate write-off of the cost of new assets related to a new mine or a qualifying expansion of an existing mine to the extent of income from that mine.

When a new mine comes into production or a major expansion of an existing mine takes place federal and provincial incentives usually ensure that little or no mining income tax will be paid in the early years or operation. However, as these write-offs are exhausted, higher mining and income taxes may result unless the mining company

incurs further deductible expenditures by opening a new mine or expanding an old one.

Federal Income Tax Rate

The net federal tax rate on taxable income is computed as follows:

Basic rate:	46%
Provincial abatement:	10%
Net Federal Tax rate:	36%

The purpose of the 10% abatement of federal tax is to give the provinces some manoeuverability in imposing their own corporate income taxes. These provincial income tax rates vary from 10% to 15% of taxable income. However, income allocated to a foreign jurisdiction does not qualify for the 10% tax abatement.

When the resource allowance, which may be deducted from taxable income, is taken into consideration the effective federal tax rate is reduced to about 27%.

Investment Tax Credit

The federal tax rules provide for an investment tax credit against federal taxes otherwise payable. This provision is intended as an incentive for regional resource development which benefits Northern Ontario. This credit varies from 7% to 20% of the cost of qualifying property depending upon the location of the mining operation. In Northern Ontario the rate is 10%. The maximum credit

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claimed in a year cannot exceed 15% + 1/2 of federal taxes payable in excess of $15,000. Any unused credit may be carried forward for five years. Note that this credit is partially offset by the reduction in the cost of related assets for capital cost allowance purposes.

Capital Cost Allowance

Mining and processing assets, social assets, and railway track are depreciable at a rate of 30% on a declining balance basis. This also applies to such assets purchased from putting into operation a new mine or from a major expansion of an existing mine.

In addition, there is provision for depreciation at a rate of 100% of capital expenditure such as mine shaft, main haulage way or similar underground work, and the costs incurred after November 16, 1978 for clearing or removing overburden from a mine after the mine came into production.

Inventory Allowance

There is an inventory allowance intended to provide some relief from the taxation of inventory profits as a result of inflation. This allowance consist of a deduction from taxable income equal to 3% of the opening inventories for the taxation year. The allowance is only available for inventories that can be incorporated into goods for sale. Supplies inventory does not

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qualify for the inventory allowance.

Resource Allowance

The resource allowance is an important incentive for companies involved in mineral operations. The allowance is equal to a deduction of 25% of certain resource profits before interest expense and development and earned depletion. The resource allowance reduces the income subject to earned depletion and thus may delay the earned depletion until later years.

Earned Depletion

An additional tax incentive provided by the federal tax regulations is an earned depletion allowance which is related to the costs involved in the exploration and development of mineral resources in Canada or in the acquisition of plant and equipment for a new mine. The earned depletion allowance is a deduction of $1 for each $3 of eligible expenditures. However, the maximum earned depletion allowance in any one year cannot exceed 25% of net resource profits. Any unused portion in excess of the above limit is carried forward to be claimed in subsequent years. All deductible costs and expenses and deductible exploration and development costs are not eligible for earned depletion.

Canadian Development Expense

A further incentive is the Canadian development expense which entitles a company to deduct 30% of the ../

unclaimed balance of certain eligible expenses. These expenses include the cost of acquisitions of Canadian resource properties and expenses prior to the start of commercial production. The deduction may be claimed whether or not the corporation has income. Any unclaimed balance may be carried forward indefinitely. After November 16, 1978, the preproduction costs may be classified as Canadian exploration expense and deducted up to 100%.

Canadian Exploration Expense

A 'principal-business corporation' (a company whose principal business is mining, oil, and gas production, or certain other activities) may claim a deduction in respect of certain expenditures incurred after May 6, 1974 to determine the existence, location, extent or quality of a mineral resource in Canada. These include prospecting, rotary diamond, percussion or other drilling, geological, geophysical, geochemical, trenching, test pits and preliminary sampling. Additionally, a company may claim development expenses incurred after November 16, 1978, and prior to the start of production to bringing a mineral resource into commercial production. Any unclaimed portions of the Canadian exploration expense deduction must be deducted to the extent of remaining income (from any source) before deducting the earned depletion allowance. A taxpayer who is not a 'principal-business

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corporation' may deduct certain Canadian exploration expenses incurred after December 31, 1981, and only the greater of his Canadian resource income and 30% of his unclaimed balance of Canadian exploration expenses prior to that date, such a taxpayer may deduct Canadian development expenses from all sources of income.

Foreign Exploration and Development Expense

A corporation may deduct the greater of its foreign resource profits and 10% of its unclaimed foreign exploration and development expenses. An amount deductible in a year may not be deferred and claimed in subsequent years. However, any portion not deductible in a year may be carried forward for subsequent years.

Provincial Income Taxes

The provincial tax rates vary from 10% in the case of Prince Edward Island to 15% in Manitoba and British Columbia. The Ontario statuary income tax rate is 13%. A summary of the provincial income taxes and the effective federal and provincial income tax rates is presented in the table below.

Provincial	Provincial Statuary Tax Rate (%)	Combined Federal-Provincial Income Tax Rate (%)
Newfoundland	14	37.5
Prince Edward Island	10	34.5
Nova Scotia	12	36.0

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Provincial	Provincial Statuary Tax Rate (%)	Combined Federal-Provincial Income Tax Rate (%)
New Brunswick	12	36.0
Quebec	12	36.0
Ontario	13	35.7
Manitoba	15	38.3
Saskatchewan	14	37.5
Alberta	11	35.3
British Columbia	15	42.0
Northwest Territories	10	34.5

The major mining producing provinces have certain tax rules which are significantly different from the federal income tax rules. Some of these differences are:

<u>Ontario</u>

1. All exploration and development costs incurred after April 9, 1974 may be fully claimed as deductible expenses.

2. An automatic depletion allowance of 33 1/3% of net income before depletion is allowed.

3. No earned depletion or resource allowance deductions are allowed.

<u>Quebec</u>

1. All exploration and development expenditures are allowed as deductions.

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2. A 33 1/3% earned depletion paralleling the federal allowance is permitted.

British Columbia

No deduction similar to the federal 25% resource allowance deduction is permitted. However, a provincial tax credit results in the deduction of disallowed provincial royalties.

Saskatchewan

1. A deduction of the 25% resource allowance
2. A tax credit equivalent to any excess of disallowed provincial royalties and mining taxes over the 25% resource allowance.

Other Provinces

The remaining Canadian taxes jurisdictions have tax provisions which are essentially similar to those of the federal income tax regulations.

PROVINCIAL MINING TAXES

Ontario Mining Tax

The following rates are applicable for Ontario mining tax purposes:

Mining Profit ($)	Marginal Tax Rate (%)	Average Rate (Top of Range) (%)
0 - 250,000	0	0
250,001 - 1,000,000	15	11.3

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Mining Profit ($)	Marginal Tax Rate (%)	Average Rate (Top of Range) (%)
1,000,001 - 10,000,000	20	19.1
10,000,001 - 20,000,000	25	22.1
20,000,000	30	-.-

The Ontario mining tax rules require that profits from all Ontario mines operated by the same taxpayer be aggregated for mining tax purposes. Exceptions to this rule where disaggregation is allowed are:

1. New mines brought into production after April 9, 1974.

2. Major expansions to new mines which result in more than 30% increase in the rate of ore production over the previous annual high (since 1968) or an increased investment of at least 25% in the cost of depreciable assets.

3. Certain inactive mines when reopened later.

4. Any other mining investment which in the opinion of the Ontario Cabinet warrants disaggregation.

The following are deductible from the gross revenue received on the sale of the output of a mine either in primary or processed state:

1) Costs of production

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2) Most processing and transportation costs
3) Exploration and development expenses
4) Processing allowance
5) Depreciation allowance
6) Operating and maintainance costs of certain social assets in Ontario

No deduction is allowed in respect of the following:

1) Interest expense and other financing charges
2) Provincial mining taxes and royalties
3) Royalties paid to a resource owner
4) Depletion
5) Administrative expenses not directly related to earning mining profits

Depreciation Allowance

Mining (but not processing or transportation) assets are depreciated over a 30% straight-line basis.

PROCESSING ALLOWANCE RATES

Degree of Processing Achieved	Northern Ontario (%)	Rest of Canada (%)
Concentrating	8	8
Smelting	16	16
Refining	25	20
Further processing (fabrication)	30	-

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The provincial mining tax rules permit a taxpayer a processing allowance based on all processing. The allowance rate is the one associated with the highest processing degree. Thus, if a company operates a concentrator, a smelter and a refinery then the applicable rate is 25% of the cost of all processing assets. The processing allowance may not be less than 15%, nor greater than 65% of mining and processing income after deducting all expenses. The maximum of 65% may be exceeded where a semi-fabricating plant is built in Northern Ontario. The processing allowance may be carried forward for three years.

Other Provinces

Although the rules affecting the calculation of mining taxes vary from one province to another, there does not seem to be a significan difference in the overall mining taxes collected by the various provinces. Thus one would not expect that a potential investor would choose, for his investment, one province over another based solely on the tax rules. Indeed, most provinces provide for a depreciation allowance, a resource allowance, an exploration and development expense allowance and a processing allowance.

Based on current tax regulations in the various provinces, it would appear that there is a high degree of consultation, cooperation, and streamlining among the provinces in devising their mining tax legislations. ../

IMPACT OF TAX CHANGES ON THE PROFITABILITY OF A MINING OPERATION IN ONTARIO

The effect of tax changes during the period 1971-75 on the profitability of a mining project in Ontario is illustrated in Figs. 31-35. The comparison is for a mining operation paying taxes according to the taxation system existing prior to the introduction of the tax reforms in 1971-72 and for the same mining operation being assessed taxes according to the tax system in effect in 1975, just prior to the removal of the deductibility of the provincial mining tax.

The profitability indicators used in the comparison comprise the internal rate of return (IRR), the net present value (NPV) and the payback period (PB). The above profitability indices are related to the revenue to operating cost ratio (θ).

Fig. 31 shows the effect on the IRR as a function of θ for the case where the exploration and development costs are negligible relative to the magnitude of the annual income. In effect this shows the impact of the change from an automatic depletion to an earned depletion allowance. It is noted that the IRR is lower for the post 1971 tax system as compared with the pre-1971

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system and that the difference increases with increasing θ up to a value of 4 and stabilizes thereafter as the operating costs become small ralative to the revenue. It is also observed that for both tax systems the IRR increases with increasing θ as would be expected.

Fig. 32 shows the variation of the PB period with θ. It is realized that the PB is higher for the post reform tax system as compared with the pre-reform system, and that the difference increases for the lower range of θ - values and stabilizes for higher θ - values.

Figs. 33-34 show the effect of the tax changes on the IRR and the PB period for the case where the exploration and development costs are 3/8 of the annual revenue. Note that these costs are incurred prior to bringing the mine into operation. It is seen that the PB period increases and the IRR decreases for both systems as compared with the case where the exploration and development costs were negligible. However, the pattern favoring the old tax system prevails.

The net present values for both tax structures are presented in Fig. 35. It is observed that, from the mining industry point of view, the old tax system is more favorable. Fig 36 shows a typical discount cash flow analysis output.

The above comparisons clearly indicate that the tax

reforms have resulted in reduced profitability for the mining industry which substantially affect the investment climate resulting in a significant reduction in exploration activity during the period 1971-75, and presumably reduced mining operations and government tax revenues in later years. Unfortunately, no data was available to show the impact of the tax reforms on government taxation revenue from the mining sector.

Indeed, and enlightened minerals policy by governments would employ a cost-benefit analysis prior to the implementation of tax charges and would effect only those reforms that produce a real rather than an imaginary benefit.

Impact of Tax Changes on Exploration Activity

Changes in the tax regulations usually have an immediate impact on the exploration rate. Unlike production, an exploration program could be cancelled with a relatively small cost being incurred. However, changes in production may lag, the tax changes by several years. This is because the mining companies investment in production is made only after a long period of planning and extensive exploration and development expenditures.

Using data from De Yound (8), the impact of tax changes on exploration in Ontario is clearly demonstrated in a sudden drop in the exploration expenditures in the

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period 1970-74 with a modest improvement in 1975 (Fig. 37). This period was characterized by radical tax reforms which created uncertainty and instability in the investment climate in Canada. Note that the rate at which tax changes take place is as important as the magnitude of the changes; the former creates confusion and inability to formulate long-term investment plans, while the latter has an impact on the profitability of a mining operation and thus may result in a reduced production. Additionally a reduction in exploration activity usually results in less production in later years.

When the mining industry considers the tax laws or other governmental mineral policies to be onerous, the investment capital usually moves to regions where the resource endowment is less favorable and the probability of discovery is lower simply because of the more advantageous tax system in these regions. Due to the several years lag between exploration and production it is advisable that policy makers understand this relationship when enacting tax changes.

Fig. 37 shows that in terms of 1970 dollars, there was a continuing decline in the outside or general exploration expenditures by the mining industry in Ontario during 1971-75. This is also true of British Columbia, Manitoba and Saskatchewan. On the otherhand the Atlantic provinces experienced a decline in exploration expen- ../

ditures until 1973 with subsequent major increases in 1974 and 1975. However, Quebec defied the general declining trend and had actually an increasing exploration expenditure profile in the period 1970-75.

The trend for the on property exploration and development expenditures paralleled that of the outside or general exploration expenditures.

In the period 1970-74, the total Canadian capital and exploration expenditures increased by about 10% in terms of current dollars. However, in constant 1970 there was a decrease of 20% with British Columbia accounting for 50% of the decline. The introduction of British Columbia's Mineral Royalties Act in 1975 appears to have contributed to the further decline in exploration activity in that province.

Other indicators of exploration activity include the amount of drilling done and the amount of claims-staking. These two indices have also registered declines during the period 1971-1974.

Conclusions

As has already been indicated in the introduction to this chapter, the Federal and Provincial governments in Canada were subjected to severe economic and political pressures which influenced them to alter their policies

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towards the minerals industry by introducing tax reforms in the late 1979's which included many new tax incentives. It appears that these tax reforms had a favorable effect on mining activity which could not be accounted for simply by the general improvement in commodity prices since the introduction of reforms. It is generally accepted that tax-law differences rather than changes in commodity prices are responsible for the shift of mineral exploration activity from one tax jurisdiction to another.

In order to predict the effect of tax changes on exploration and mining activity in general, it is important to compare the Canadian tax system with the taxation systems prevailing in other countries competing for investment in the minerals industry. In particular, the investment climates in the U.S.A. and Australia should have a significant bearing on Canada's tax system and minerals policy. These two countries are considered to be Canada's major competitors for investment by mining industry.

In addition, Canada should avoid the frequent Federal-Provincial debacles over natural resources such as the current (Aug. 1981) difficulties between the Federal and Alberta governments over oil pricing and royalties. Such difficulties usually lead to instability and uncertainty in the mining industry and puts pressure on investment to leave Canada to other more stable tax jurisdictions.

It is also desirable that the Canadian Federal ../

and Provincial governments increase their activity in mineral exploration and exploitation so as to lessen the impact of the flight of capital during periods of uncertainty. What is required is a gradual rather than an abrupt and radical change in the tax laws so as to provide the needed stability for the investor to embark on long-range planning without the fear of unpleasant surprises few years later. Such an enlightened policy should also result in increased tax revenues for the various governments in Canada.

MINING AND MILLING METHODOLOGY AND COSTS

Mining Methods

Five mining methods were used in the analysis for the purpose of comparison. These methods are the most commonly used in hard-rock mining. The methods are: Open pit; cut and fill, blast hole, shrinkage, and room and pillar. The recovery and dilution factors associated with these methods are presented in Table 13.

Milling

It was assumed that no processing beyond the milling stage will take place on site. However, for the economic analysis 20% of the revenue was charged to further processing and marketing. The mill recovery factors used for the various commodities are shown in Table 14.

TABLE 13: MINE RECOVERY AND DILUTION FACTORS

METHOD	RECOVERY FACTOR	DILUTION FACTOR
Open pit	0.95	0.16
Cut and fill	0.92	0.08
Blast hole	0.84	0.16
Srhinkage	0.89	0.12
Room and pillar	0.89	0.11

TABLE 14: MILL RECOVERY FACTORS USED IN ANALYSIS

METAL	MILL RECOVERY
Cu	0.85
Zn	0.90
Pb	0.55
Ni	0.90
U	0.80
Au	0.70
Ag	0.82
Fe	0.87
Li-Cb	0.90
$Cr_2 0_5$	0.65
Co	0.88
Platinum	0.70
Other	0.90

TABLE 15

FORMULAE FOR MINING OPERATING AND CAPITAL COSTS FOR VARIOUS MINING METHODS

Mining Method	Operating Costs ($/ton) Labour	Supplies
Open Pit	$58.563\ Tp^{-0.5} + 3.591\ Tp^{-0.3}$	$13.4\ Tp^{-0.5} + 1.24\ Tp^{-0.3} + 0.9\ Tp^{-0.2}$
Cut and Fill	$515.6/\ (T^{0.3}\ W^{(0.5)})$	$13.2/\ (T^{0.3}\ W^{0.2})$
Blast Hole	$1858/\ (T^{0.5}\ W^{0.5})$	$26.51/\ (T^{0.2}\ W^{0.2})$
Shrinkage	$425/\ (T^{0.3}\ W^{0.5})$	$10/\ (T^{0.3}\ W^{0.2})$
Room and Pillar	$205.5/\ (T^{0.3}\ W^{0.5})$	$14.05/\ (T^{0.1}\ W^{0.2})$

Mine/Mill Capital Costs ($)

Open Pit	$400{,}000.\ T^{0.6}$
Underground	$800{,}000.\ T^{0.6}$

Where:

T = tons of ore mined daily

Tp = combined ore and waste tonnage mined daily

W = stope width in feet

Costs

Several types of costs are usually incurred in locating, developing, producing, and milling a mineral. In order to provide flexibility in the analysis, most of the costs were expressed in the form of functional relationships in terms of the daily production rate. After searching the literature, it was decided to use the equations presented by O'Hara (4). These equations were developed by computerized statistical analyses of the best fit of the data to an equation of the form $Q = KT^x$ where Q represents the actual data on quantities required for cost, and T refers to the daily tonnage rate or other physical conditions causing changes in quantities or costs. The x values were determined to yield the lowest range of variation in K values across the widest range of T values for which reliable data were available.

Mining Costs

The mining operating and capital costs associated with the various mining methods were expressed in terms of the daily production rate. The formulae used which were obtained from Ref. 4, are given in Table 15. Since the expressions shown in Table 6 were in terms of 1978 dollars, an inflation factor of 13% was applied to these formulae to transform them to 1979 costs.

Mill Operating Costs

To account for the difference between base metals and precious metals operating costs two different for- ../

mulae are used (Ref. 4). These are:

Base Metals Operating Costs:

$$\text{Labour} = 93\ T^{-0.5}$$
$$\text{Supplies} = 21.5T^{-0.3}$$

Precious Metals operating Costs:

$$\text{Labour} = 97\ T^{-0.5}$$
$$\text{Supplies} = 15.2T^{-0.3}$$

Development Costs

The development costs are expressed in terms of the daily production rate. Two formulae, one for open pit and the other for underground mining were used (Ref. 4) and are given below:

$$\text{Open pit development costs} = 8500T^{0.5}$$
$$\text{Underground development costs} = 40{,}000T/W^{0.8}$$

Exploration Expenditures

Exploration is the first stage in a chain of activities which being an uncertain geologic resource into a marketable product. The probability of discovering an economic deposit increases with an increase in exploration expenditures. Although there are functions expressing the exploration costs in terms of several variables (Ref. 5), such as topography, overburden, and climate, it was decided to use a more recent formulae by MacKenzie (Ref. 3):

$$A = C \frac{[\log(1-P)]}{[\log(1-p)]}$$

Where: A = Exploration funds required to have a confidence P of discovering at least one economic deposit.

P = Probability of making at least one economic discovery after expending an amount A.

p = The probability that a discovered deposit is economic.

C = Average or typical exploration cost.

For the Monte Carlo simulation only P was considered to be a random variable with a most likely value of 2% (Ref. 3), a low value of 1.5% and a high value of 2.5%. P was taken as 0.3.

TRANSPORTATION COSTS

The trasnportation capital costs were calculated for a maximum distance of one hundred miles from the mine site. At a cost of $200,000 per mile, the maximum value was taken at $20 million, while the most likely value was taken at $8 million, and the lowest value at $4 million.

ENVIRONMENTAL COSTS

Since most of the environmental expenditures are likely to take place during the period of capital expenditure, the environmental costs were taken as a propor-../

tion of the capital cost. The most likely proportion was taken as 10% with a low value of 8%, and a high value of 12%.

ROYALTY

In this study the royalty was based on gross revenue, although other researchers (Ref. 2) use net of after tax revenue as a basis of the royalty. For this study the most likely value was taken as 1% with a low value of 0.5%, and a high value of 1.5% of gross revenue.

ECONOMIC FEASIBILITY MODELS FOR POTENTIAL MINERAL DEPOSITS NORTH OF 50°N USING PROBABILITY IN ONTARIO

The evaluation of a mineral endowment of a vast regime such as that of Northern Ontario is an extremely complex undertaking. Some of the factors contributing to the complexity of the evaluation are:

1. The exploration data is sparse and if available, there is general reluctance on the part of the mining companies which are privy to this data to relcase such information.

2. The available analytical techniques for estimating the existence, the size, grade, and distribution of mineral deposits are dependent on subjective assessments supplied by individuals who cannot be considered as ../

being disinterested in the outcome of the study.

3. The inherent difficulty in predicting important factors such as the global and domestic supply and demand for minerals, the price fluctuations and the world economic and political stability.

4. The changing governmental tax and environmental regulations and the difficulty associated with predicting these changes over a long period of time, as these are arrived at based to a large extent on political rather than purely economic considerations.

5. The unpredictability of new competitive deposits and technologie which might or might not be within the jurisdiction of Ontario or Canada.

The above mentioned difficulties should not diminish the importance of investment mathematical models for project feasibility analysis. These models provide an overview of the financial framework within which explorationists, mine developers, and investors work. This type of analysis provides several criteria of profitability for selecting a mining system, processing method, production rate, price, cut off grades, etc.

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Some of the profitability indicators are the pay back period (PB), the internal rate of return (IRR) and the net present value (NPV).

EVALUATION PROCEDURE FOR A POTENTIAL MINERAL DEPOSIT

The purpose of an evaluation of the potential of a mineral deposit is to provide management and potential investors with important decision making tools. Although other analytical techniques are available, the discounted cash flow (DCF) method coupled with sensitivity and risk analysis appears to provide the necessary criteria, such as IRR, pay back period and net present value for assessing the feasibility of a project and for ranking the various investment alternatives.

RATE OF RETURN

The objective of an economic analysis is to determine the profitability of a project by calculating certain profitability indicators, such as the rate of return on investment, the pay back period and net present value.

The return on investment can be computed using the accounting rate of return (ARR) or more commonly the internal rate of return (IRR).

Accounting Rate of Return

This describes a number of similar methods which ../

use accounting records to measure profitability as an annual percentage of the investment. One approach calculates average after tax income as a percentage of average investment, while a second method uses original rather than average book value.

The accounting rate of return is a non-discounted method and thus fails to account for the time value of money or the life of the project. This method is not used in this study as a profitability indicator.

Internal Rate of Return (IRR)

The internal rate of return identifies the implicit return that is generated by the project, hence the term "internal." This method takes the cash flows and the time value of money into consideration. The IRR is the discounted rate which will make the NPV of the project equal to zero.

The major drawback of the IRR is that it does not consider the size of the investment or the life of the project. Thus, if used as a means of ranking for purposes of project selection, it may lead to sub-optimal decisions.

The IRR is used as a profitability indicator in this study. The mathematical expression that is used to calculate the IRR is as follows:

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$$\sum_{i=o}^{N} \frac{CFi}{(1 + IRR)^{i}} = 0$$

Where: IRR = internal rate of return

N = total life of the project including investment and operation periods.

i = an index which ranges from 0 to N and denotes each year in the life of the project.

Net Present Value (NPV)

The net present value is a discounted cash flow method which determines the present value of all the cash flows from a project after they have been discounted at the required rate of return. The lattes being a chosen rate of return which reflects the opportunity cost of the investment and the risk involved in investing in the project.

The net present value is the cumulative sum of the discounted cash flows (including the negative cash flows). This method is used by many investors as the basis for investment decisions, since the NPV represents the "profit" that a project yields. Mathematically, the NPV is represented by the following expression:

$$NPV = \sum_{i=0}^{N} \frac{CFi}{(1 + DR)^{i}}$$

Where DR is the required rate of return.

Payback Period (PB)

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The payback period is commonly used as a simple yard stick for assessing the profitability of a project. The PB period is the time required for the cash flows to return the original investment. It does not take the time value of money or the life of the project into consideration. Thus, its use is usually limited to situations where very risky projects are involved. In such a case a short payback period may be considered an adequate guarantee against loss. Mathematically, the payback period is expressed as:

$$\sum_{i=1}^{PB} CFi - TI = 0$$

Where TI is equal to the total investment. Note that in the above expression the payback period is measured from the start of production. Other variants measure PB period from the start of the exploration activity.

TREATMENT OF INFLATION FOR CASH FLOW ANALYSIS

Inflation represents the continuing depreciation of money in terms of its buying power. Inflation affects all costs and revenues and thus cash flow analysis must make adjustment for inflation. Whitney and Whitney (6) list flow methods for taking inflation into account for cash flow analysis.

1. All costs and revenues are estimated in terms

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of constant dollars as at the start of the study. This approach has the following implications:

a) Future costs and revenues are assumed to inflate at the same rate.
b) Capital costs and taxes payable are underestimated.

2. All variables are inflated to one value expected at the start of production and thereafter constant dollars are used. This underestimates taxes payable and equipment replacement costs.

3. A constant rate of inflation is assumed for each variable and each variable is then inflated by its rate. The implications are:

a) IRR will have the inflation rate built in.
b) Discount rate should be adjusted for inflation.

4. Assume an explicit inflation rate for each variable, for each year in the life of the project. Inflate the cash flow components through the life of the project. Then deflate the annual net cash flows at an average inflation rate. Use the deflated cash flows to perform the DCF analysis.

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For this study method 1 was used and the analysis was done in terms of 1979 contant dollars.

Commodity Prices

The commodity prices used in this study were 1979 average prices, for the deterministic analysis. A skew price distribution utilizing the 1979 low, average and high price values was used in the risk analysis the 1979 prices of the various commodities are shown in Table 13.

TABLE 16: COMMODITY PRICES (1979 VALUES)

		Low	Average	High
Cu	(¢/lb)	73.27	92.33	111.69
Tn	(¢/lb)	34.37	37.30	39.50
Pb	(¢/lb)	39.60	52.64	61.88
Ni	(¢/lb)	2.06	2.72	3.15
Mo	($/lb)	5.55	6.13	7.50
U	($/lb)	40.75	42.57	43.25
Au	($/oz)	227.38	307.61	461.01
Ag	($/oz)	6.25	11.09	21.79
Fe	($/ton)	60.90	65.30	67.80
Li-Col	($/lb)	5.00	5.47	10.00
Coal	($/ton)	40.00	40.00	40.00
Cr_2O_5	($/lb)	50.00	55.00	60.00
Diam.				
Co	($/lb)	20.00	24.58	25.00
Platinum	($/oz)	300.00	352.33	400.00
Other	(¢/lb)	40.00	50.00	60.00

PROJECT SELECTION

Two approaches are commonly used for project selection. These are the "hurdle" approach and the "ranking" approach. The IRR and NPV are the optimal profitability indicators which are used in "hurdling" and "ranking."

The Hurdle Approach

In this method a project must exceed minimum set goals; for example, the IRR should be greater than the company's required rate of return, or the NPV should be positive. Projects that meet the set goals are further evaluated based on non-economic considerations.

The Ranking Approach

This approach ranks project in order of increasing importance according to a profitability index, such as IRR or NPV. Projects are selected from the top of the list until the budget has been allocated or all the acceptable projects have been selected.

Risk Assessment

In assessing the potential of a mining project, the parameters difining the economical model of the project are seldom known with a high degree of reliability.

Indeed, the value of a parameter is more realistically described by a range of values than by a single value. In addition, an investor usually would like to study the ../

effect of the change in one or more parameters on the profitability of the project. Three approaches for evaluating project risk are used in this study. These are:

1) Sensitivity analysis
2) Monte Carlo simulation
3) Expected value approach

Sensitivity Analysis

This is an approach whereby the values of certain parameters are changed independently of one another in order to determine their effect on the profitability of a project. The importance of sensitivity analysis lies in the identification of these parameters that have significant influence on the profitability of a project, so as to enable management to concentrate only on these important variables to the exclusion of the less significant variables. Sensitivity analysis can also be used as further data becomes available at various stages in the development and operation of a mine.

In this study fourteen parameters were varied in order to determine their effect on the IRR, the PB, and the NPV. These parameters are: price, grade, average tonnage/deposit, mill recovery, mining cost, mine recovery, dilution factor, capital cost, development cost, exploration cost, royalty, environmental cost, transportation cost, and milling cost.

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Monte Carlo Simulation

Monte Carlo Simulation is a procedure whereby all the input variables are varied simultaneously and in a random manner. For each simultaneous random changes the IRR, PB, and NPV are computed. The process is usually repeated a large number of times (500 in this study). This results in a probability distribution for the profitability indices as shown in Fig. 38. The step procedure is as follows:

1. A probability distribution is assigned to each input variable. These probability distribution are shown in Table 17.

2. A random number generator is used to select a random number between 0 and 1.

3. Using the random number generated in step 2, a discrete value is determined for one of the input variables using its probability distribution.

4. Repeat steps 2 and 3 for all the input variables.

5. On the basis on these randomly selected values, calculations are made of revenues, costs, and other items necessary for a DCF analysis. The result is values for IRR, PB, and NPV.

6. Repeat steps 2 to 5 a large number of times (500 iterations).

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TABLE 17: TYPE OF DISTRIBUTION FOR THE INPUT VARIABLES

Commodity	Distribution Type
Price	Skew
Grade	Normal
Tonnage/deposit	Normal
Mill recovery	Normal
Mining cost	Normal
Mine recovery	Normal
Dilution factor	Skew
Capital Cost	Normal
Development Cost	Normal
Exploration Cost	Skew
Royalty	Skew
Environmental cost	Skew
Transportation cost	Skew
Milling cost	Normal

The above procedure results in a frequency distribution for the IRR and other profitability criteria. This will give the probability that at least a certain level of IRR can be realized by the project under consideration.

PROBABILITY DISTRIBUTIONS USED

Point Estimate

A point distribution is the simplest of all probability distribution. When a variable is fixed and known beforehand, then it is represented by a point estimate.

Rectangular Distribution

When a value of a variable has an equal probability of occurring anywhere within the specified range of the variable, then it is represented by a rectangular distribution. This is completely determined by specifying the range of the variable.

Normal Distribution

The normal distribution assumes that the values of a variable can be estimated fairly accurately, but in practice it has an equal chance of being above or below the estimated value. This distribution is used for variables that occur most frequently in the middle range but has an equal chance of being above or below the middle. This distribution is completely described by its mean and standard deviation.

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Skew Distribution

This distribution is used when a variable has a greater chance of occurring above or below the mode. Although the Beta distribution can be used, it is customary to replace it by a triangular distribution. The latter is completely specified by its mode, and its range.

Risk Capacity

The risk capacity expression (Ref. 6) enables the investor to estimate the minimum acceptable probability of success required for a project in order to meet a required rate of return. This minimum probability of success is given by:

$$P = \frac{1}{\left(\frac{A}{B} + 1\right)}$$

Where P = Risk capacity

A = NPV for a successful project

B = NPV of after tax cost of failure

If management does not believe that this type of project has at least a probability P of success, then the project should not be undertaken.

EXPECTED IRR AND NPV

The expected IRR or NPV is the weighted average of the distribution generated by the Monte Carlo Simulation.

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The expected IRR or NPV can be used for the "ranking" and "hurdling" in the same manner as the point estimates can be used. The expected values are more realistic to use than point estimates for project selection.

MONTE CARLO SIMULATION - RESULTS AND DISCUSSION

As mentioned earlier, the Monte Carlo Simulation shows the effect of the randomness of the input variables on the profitability of a project.

In this study fourteen random input variables were used. The Monte Carlo Simulation was repeated 500 times (comparisons of runs with 500 and 1000 iterations showed an insignificant difference in the resulting probability distributions and thus for economy in computer time the number of iterations was taken as 500). The simulation analysis was done for all commodities in all ten blocks for open pit, cut and fill (C and F), and blast hole (BH) mining methods. The mining rate was varied from 1000 - 8000 tons/day for the last two methods. For the open pit method the mining rate was varied from 4000 - 16000 tons/day with a waste-to-ore ratio of 5. Note that since the overburden and the depth of the ore have not been estimated, it was decided to provide results for both open pit and underground operations.

The Monte Carlo Simulation provided probability distribution for IRR, PB, NPV, Cash Flows, Cut-off grade, ../

Capital Costs, Operating Costs, Revenue, Net Value, Mine Life, and Exploration Expenditures. These were printed out and are appended to this report.

The profitability of the various deposits is described in terms of the IRR and is shown in Figs. 39-160. To simplify the plotting only the median, lower quartile and upper quartile values of the IRR are shown. The diagrams also show the impact of the mining rate on the IRR for the various mining methods. The results are summarized briefly below for each commodity.

1. Copper

Copper appears to occur in uneconomic deposits. The maximum median value of the IRR for cut and fill and blast hole is only about 2% in block 10. However, the copper in block 1 is potentially economic if open pit is a suitable mining method. The maximum median IRR is about 20% which corresponds to a mining rate of 4000 tons/day. Note that all the copper deposits are uneconomic if a 25% rate of return is required. This is the case irrespective of the mining method used.

2. Copper - Zinc

The Copper - Zinc deposits appear to be uneconomic if mined by cut and fill or blast hole. The maximum median IRR is about 5% occurring in blocks 2 and 4. However, the results for open pit indicate economic deposits in blocks 1, 2, 3, 4, and 6.

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The maximum median IRR is of the order of 35%.

3. Copper - Lead - Zinc Deposits

Copper - Lead - Zinc deposits occur in most blocks. Most of these deposits appear to be profitable even when mined by cut and fill. In particular the deposits in blocks 4, 5, 8, 9, and 10 yielded a median IRR of between 22 and 35%. These high values of the IRR are associated with a mining rate of 8000 tons/day, except for block 10 where the maximum IRR corresponds to 4000 tons/day.

4. Lead - Zinc

The cut and fill and blast hole methods yield potentially profitable deposits only in blocks 3 and 4. The maximum median IRR for these two blocks are 15% and 23% respectively and both corresponding to a mining rate of 8000 tons/day.

Open pit mining shows that blocks 2, 3, 4, and 5 are profitable with the maximum median IRR ranges between 25% and 45%. These values occur at 16,000 tons/day. The deposits in block 10 give a maximum median IRR of only 6% which indicates that this deposit is not profitable.

5. Nickel - Copper Deposits

The cut and fill and blast hole methods yield uneconomic deposits for nickel-copper in all blocks in which these deposits occur. The maximum median IRR of 13 occurred in block 7.

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Mining the nickel-copper deposits by open pit indicates profitable deposits in blocks 2, 3, 6, and 7, where the maximum median IRR ranges from 22% to 40%. All these values are associated with a 16,000 tons/day mining rate.

6. Molybdenum

Molybdenum occurs in blocks 1 and 6 only. The CF and BH results indicate that the deposits in both of these blocks are uneconomic yielding a maximum median IRR of 9%.

Using open pit the deposits in both blocks appear to be economic. The maximum median IRR in blocks 1 and 6 are 35%. For block 1 this high value is associated with 2000 tons/day, while in block 6 the high value corresponds to 8000 tons/day.

7. Uranium

Uranium occurs in all blocks except blocks 5 and 8. The CF and BH results indicate economic deposits in blocks 2, 3, 4, 6, 7, 9, and 10. Blocks 2 and 3 are particularly profitable with a maximum median IRR of 80% and 65% respectively.

The open pit method shows extremely profitable deposits in all the blocks in which Uranium deposits occur. Blocks 2 and 3 show maximum median IRR of 200% and 160% respectively. The IRR of return for the other blocks varied from 45% to 75%.

It is to be emphasized that these high rates of IRR are as a result of the very high price of Uranium in 1979.

8. Gold

Gold occurs in all blocks with the exception of blocks 4 and 10. The CF and BH methods indicate uneconomic gold deposits. Block 5 has a maximum median IRR of 15% at a mining rate of 8000 tons/day.

All the deposits appear to be economic using open pit. Block 3 has a maximum median IRR of 50% while blocks 1, 2, 5, and 6 have IRR ranging from 20% to 30%. Blocks 8 and 9 are totally uneconomical.

9. Silver

Although Silver occurs in 5 out of the 10 blocks, none of the deposits are economic or marginally profitable using any of the mining methods. Indeed all the IRR are negative!

10. Iron

Iron occurs in large quantities in blocks 1, 2, 3, and 6. Inspite of its abundance, it is only marginal when mined by open pit. The maximum median IRR for all blocks is 18%, for a mining rate of 32,000 tons/day. Due to the large quantities invoved, it is possible that a rate greater than 32,000 tons/day would yield a higher rate of return and could possibly make these deposits economical.

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11. Lithium - Columbium

Lithium - Columbium deposits occur in 7 of the 10 blocks. All the deposits appear to be highly profitable. For CF and BH the maximum median IRR ranges from 30% in block 6 to 85% in block 3. For open pit the corresponding IRR ranged from 35% in block 6 to 190% in block 3. The high price of Lithiu-Columbium in 1979 may account for this high profitability.

12. Coal

Coal occurs in block 4 only. It is uneconomical deposit.

13. Chromium

Chromium occurs in block 1 and 7 only. The deposit in block 1 is uneconomical irrespective of the mining method used. The results of the blast hole and cut and fill methods indicate profitable deposits in block 7. The maximum median IRR of return is 29% and corresponding to a mining rate of 8000 tons/day. Using open pit mining the maximum median IRR is 54% and corresponds to 16000 tons/day.

14. Diamond

Diamond occurs in blocks 4 and 5. Using the underground mining methods, these deposits appear to be uneconomical. No attempt was made to properly account for the cost involved in diamond mining.

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15. Cobalt

Cobalt occurs in block 1 only. The CF and BH methods indicate highly profitable deposit having a maximum median IRR of 240%. Again, the high price of Cobalt in 1979 is responsible for this high profitability.

16. Platinum

Only block 7 contains platinum. The deposit is uneconomical irrespective of the mining method used.

CONCLUSIONS

The following conclusions are drawn:

1. For the majority of deposits, cut and fill is more profitable than blast hole; however, the difference is not substantial.

2. The most economic mining rate is in the range of 4000 to 8000 tons/day for the underground mining methods.

3. Using a 25% required rate of return, the Copper deposits are uneconomical irrespective of the mining method used.

4. As expected, the profitability of Open Pit mining is higher than that of the underground mining methods.

5. Using Open Pit, the optimum profitability corres-

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ponds to 4000 tons/day for small size deposits, 8000 tons/day for medium size deposits, and 16,000 tons/day for large size deposits; however, for iron the rate for profitable mining is greater than 32,000 tons/day.

6. Due to the marginal grades and small gold deposit sizes, most of the results indicate unprofitable deposits. The only exception is the deposits in block 3 when mined by open pit, which is not a common mining method for gold in Canada.

7. Cu-Pb-Zn deposits appear to be profitable when the ore deposits are large.

8. Uranium deposits appear to be profitable using 1979 prices. However, present prices are only about 50% of that price and, therefore, these deposits may not be economical at current prices. Also, the rich Uranium deposit findings in Saskatchewan will reduce the importance of the Uranium in the study area.

9. The most recent boom in the electronics industry has contributed to the recent high prices for Li-Cb and, therefore, Li-Cb deposits in the study area appear to be highly profitable.

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SENSITIVITY ANALYSIS RESULTS AND DISCUSSIONS

As it is explained earlier, the sensitivity analysis has been conducted for each metal by varying 14 parameters. In this section the results of this analysis is being discussed individually for the existing minerals in the study area. The graphical analysis are illustrated in Figs. 161 - 230.

Copper

The profitability of the copper deposits in blocks 1, 3, 5, and 10 are sensitive to the parameters such as price, size of the deposit, grade, mine and mill recovery and capital cost. The optimum production rate for open pit mining is 4000 tons/day, and IRR is varied between 22 to 38% for the majority of the copper deposits when the parameters were varied by $\pm$ 10% and in this case, the most economic mining method is proven to be open pit.

Copper - Zinc

The profitability of the copper - zinc deposits in block 1 are sensitive to the parameters such as price, size of the deposit, grade and mill recovery. The optimum production rate for open pit and underground mining is 8000 tons/day, with the exception that for price and grade parameters, it is 4000 tons/day for underground mining. ../

For open pit mining IRR is varied between 20-27% and for undeground mining 2 to 10%.

In block 2 open pit mining method is sensitive to the price, grade, mine and mill recovery. When these parameters were increased by 10% IRR shifted from 3% to 20% for 4000 ton/day open pit mining, but did not affect the profitability of underground mining. Most profitable production rate for underground mining is 8000 tons/day and IRR is 8% in most of the cases.

In block 3 the optimum mining rate for both open pit and underground is 8000 tons/day and is not sensitive to any of the parameters. IRR for open pit is 22% and for underground 3%.

In block 4, 5, and 6 both of the mining methods are sensitive to the parameters such as price, grade, capital cost and mine and mill recovery. The optimum production rate for open pit is 8000 tons/day and IRR varies between 33 and 44% in block 4, and 21 to 32% in blocks 5 and 6. The optimum production rate for undeground mining method is 4000 tons per day and IRR varies between 3 and 8%.

Base Metals (Pb-Zn-Cu)

In blocks 1, 6, and 7 for open pit and underground mining methods, the optimum production rate is 8000 tons per day and they are sensitive to price, size of the ore-

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deposit, and mill recovery, and the IRR varies between 27 and 35%. However, in the case of underground mining method when the production rate is 4000 tons/day, the operation is sensitive to price, capital cost, grade and mill recovery. When the capital cost is reduced by 10% and price, grade, and mill recovery is increased in the same amount, the IRR shifts from 4% to 18%. This indicates that the ore-deposit grades are marginal and profitability would improve with better grade and recovery.

In blocks 2 and 3 similar observations as above are pertinent; however, average IRR for underground mining method is 20%. This is an indication that the grades of the deposits in these blocks are better.

In blocks 4, 5, 8, and 9 again the optimum production rate for both underground and open pit methods is 8000 tons per day and they are sensitive to change in price, ore-deposit size, grade, mine and mill recovery and capital cost. For open pit the IRR varies between 70 and 85% and for underground method the IRR varies between 29 and 39%.

In block 10 the optimum production rate for both mining methods is 4000 tons/day and they are sensitive to change in price, mill, and mine recovery, capital cost and grade. The IRR varies between 60 to 76% for open pit and 15 to 28% for underground.

Lead - Zinc ../

In blocks 2 and 3 the optimum production rate is 8000 tons/ day for both mining methods and IRR varies between 28 and 37% for open pit and 15 to 19% for underground methods when the parameters price, ore-body size, grade, mill recovery and capital cost changes by ± 10%.

Again in blocks 4 and 5 the optimum production rate is 8000 tons/day for both mining methods; however, in block 4 IRR flactuation for the open pit is 33 to 37%, and for the underground method is 22 to 25%, and in block 5 because of the poor grades and small ore-body sizes, the IRR varies between 16 and 19% for open pit, and 3 to 8% for underground mining method.

In block 10 practically all of the ore bodies are uneconomical and only for open pit method a 6 to 8% IRR is feasible. The optimum production rate is 8000 tons/day.

Nickel - Copper

Nickel - copper deposits in block 1 are sensitive to changes in price, mill and mine recovery, development and capital costs, and grade. The underground mining methods are not economical and the optimum production rate for open pit mining is 4000 tons/day with IRR variations from 23 to 30%.

In blocks 2, 3, and 7 optimum production rate for both open pit and underground methods is 8000 tons/day and there is not a significant sensitivity to the changes ../

in any of the parameters. However, the profitability of 4000 tons/day production rate is sensitive to changes in price, mining and capital costs, mill and mine recoveries and grade. The IRR for open pit method is between 26 to 32% and for underground method is 6 to 12%.

In block 6 again the optimum production rate for both open pit and underground methods is 8000 tons/day. There is a significant change in profitability when the parameters such as price, capital cost, mine and mill recovery and grade are changed by ± 10%, and little change for parameters such as size of ore deposit, mining and development costs and dilution. The IRR for open pit varies from 33 to 43% and for undeground method varies between 2 and 10%.

Molybdenum

In block 1 the optimum production rate is 2000 tons/day for both of the mining methods. The most important parameters for the sensitivity analysis for molibdenum are prices, size of the ore-deposit, mine and mill recovery, dilution, capital cost and grade. Development cost is an important parameter for only underground mining. The IRR for open pit varies between 41 to 53% and for underground between 5 and 10%.

For block 6 the optimum production rate is 8000 tons/day because ore deposits in this block are larger than the block 1. The profitability is sensitive to the changes in

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the same parameters as above. IRR for open pit varies between 33 to 43% and for underground between 3 to 12%.

Uranium

In block 1 the optimum production rate for underground mining is 2000 tons/day and for open pit is 8000 tons/day. In the case of 4000 tons/day underground mining, significant changes occurs in profitability when the price, mill recovery, and grade increases. The mining operations in this block are not sensitive to other changes. The IRR for open pit is 32% and for underground it varies between 4 and 17%.

In block 2 and 3 the optimum production rate is 8000 tons/day and again underground mining is sensitive to price, mining and capital cost, mine and mill recovery, and to the grade changes at 4000 tons/day. Normally IRR for open pit is 160% and for undeground it is 80%.

In blocks 5, 6, 7, and 9 the optimum production rate is 8000 tons/day. The uranium mining in these blocks are not too sensitive to any of the parameters with the exception of price and grade. The IRR for open pit in block 5 is 60%, in block 6 is 75%, in block 7 is 35%, and block 9 is 50%. The IRR for underground in block 9 it is 22%.

In block 10 there is not a large difference in the IRR for both of the production rates, 4000 tons/day and

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8000 tons/day, and mining methods; furthermore, there is no significant sensitivity to any of the parameter changes. Only exception is that size of the ore deposits does affect the profitability. The average IRR for open pit is 33% and for underground is 23%.

Gold

In blocks 1, 2, 3, 5, 6, 7, and 9 the optimum production rate for underground mining is 2000 tons/day and it is sensitive to price and grade, mine and mill recovery, and capital cost changes. Due to small size of the ore bodies mining at large production rates is not economical. The IRR varies between 3 and 10%. However, if the grades would increase more than 10% the profitability would increase substantially.

Silver

In all blocks silver is not economical to mine by underground mining methods. In blocks 1, 2, and 3 the optimum production rate is 8000 tons/day and average IRR is 8%. Similar to gold findings it is sensitive to price, grade, mine and mill recovery and capital cost changes.

In blocks 5 and 9 optimum production rate is 4000 tons/day and in block 6 it is 2000 tons/day. The IRR for block 6 it is between 15 to 20%. Sensitivity is same as above.

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Iron

Iron, at low production rates, such as 8000 tons per day is not economical to mine and also it is not too sensitive to any of the small amount changes in parameters, such as ± 10%. Almost in all blocks (1, 2, 3, and 6) the IRR for open pit is calculated to be 9%.

Lithium - Colombium

In all blocks (1, 2, 3, 5, 6, 7, and 9) lithium-columbium is sensitive to price, size of ore deposit, grade, mine and mill recovery, and capital cost changes.

In block 1 the IRR for open pit ranges between 100 and 140% at an optimum production rate of 8000 tons/day. The IRR for underground mining ranges between 40 and 60% at an optimum production rate of 4000 tons/day.

In block 2 the optimum production for open pit is 8000 tons/day and the IRR is ranging between 92 to 110%. In the case of underground mining method, there is no distinct difference in optimum production rates of 2000 and 4000 tons/day, and average IRR is 40%.

In block 3 optimum production rate for open pit is 8000 tons/day and the IRR varies between 140 and 180%. In the case of underground operation, there is no significant IRR changes for varied production rates (2000 to 8000 tons/day) and the average IRR is 60%.

In block 5 the optimum production rate for both mining methods is 8000 tons/day and average IRR is 65

../

and 45% for open pit and underground mining methods respectively.

In block 6 the underground mining is not economical, and optimum production rate for open pit is 2000 tons/day. The IRR varies between 48 and 68%.

In block 7 for both mining methods optimum production rate is 8000 tons/day and average IRR for open pit is 75% and for underground is 50%.

In block 9 again the optimum production rate for both mining methods is 8000 tons/day. The average IRR for open pit is 100 and for underground 50%.

Cromium

In block 1, the size of the ore deposit is small; and therefore, the optimum production rate for both mining methods is 2000 tons/day. Both open pit and underground mining methods are sensitive to the changes in price, size of ore body, grade, and mine and mill recovery; however, capital cost changes affects only open pit operation, and development cost changes affects only underground operation.

In block 7 for both mining methods 8000 tons/day is the optimum production rate and average IRR for open pit is 40 and for underground is 28%.

Cobalt

The only economic ore body is existing in block 1

../

and for open pit mining the optimum production rate is 8000 tons/day, and for underground, 4000 and 8000 tons/day production rates gives similar IRR. Both mining methods are sensitive to price, grade, and mine and mill recovery changes, and open pit is sensitive to capital cost changes as well, but underground mining method is sensitive to development cost and not to capital cost.

Platinum

The only economical ore body is existing in block 7 and for both mining methods optimum production rate is 8000 tons/day. For small parameter changes such as $\pm$ 10% neither of the mining methods is sensitive, and average IRR for open pit is 17 and for underground is 5%.

Conclusion

In majority of the cases the profitability is most sensitive to the changes in parameters such as: price, grade, size of the ore deposit, capital cost, and mine and mill recovery. However, distinct difference between underground and open pit mining is that underground mining profitability is more affected by the changes in development cost than in the case of open pit and not as much affected by the capital cost changes as the open pit is affected.

Dilution is found to be an important and sensitive parameter for the molibdenum and nicel-copper deposits

../

in the study area. Iron ore deposits showed sensitivity to the production rate, and as the production rate increased the profitability increased as well.

In the case of gold it is most sensitive to the changes in parameters such as price, size of the ore deposit, grade and recovery.

Mining and milling costs have very minimal effect on the variability of the profit. Since all of the parameters were varied by only $\pm$ 10% the effect of environmental cost, transportation cost and exploration cost were not measurable. However, in the marginal cases all cost changes have substantial impact on profitability.

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4. O'Hara, I. A., "Quick Guides to the Evaluation of Orebodies," CIM Bulletin, February, 1980.

5. Harris, D. P., Fregaran, A. J. and Barry, G. S., "The Methodology Employed to Estimate Potential Mineral Supply of the Canadian Northwest... An Analysis Based Upon Geologic Opinion and Systems Simulation," Mineral Information Bulletin MR 105, Mineral Resources Branch, Department of Energy, Mines, and Resource, Ottawa, 1970

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7. Azis, A., Janakiraman, C. and Werner, A. B. T., "A Computer Simulation Model for the Assessment of Mineral Resources," Department of Energy, Mines Aid Resources, Ottawa, Canada.

8. De Young, J. H.; "Measuring the Economic Effects of Tax Laws on Mineral Exploration," U. S. Geological Survey.

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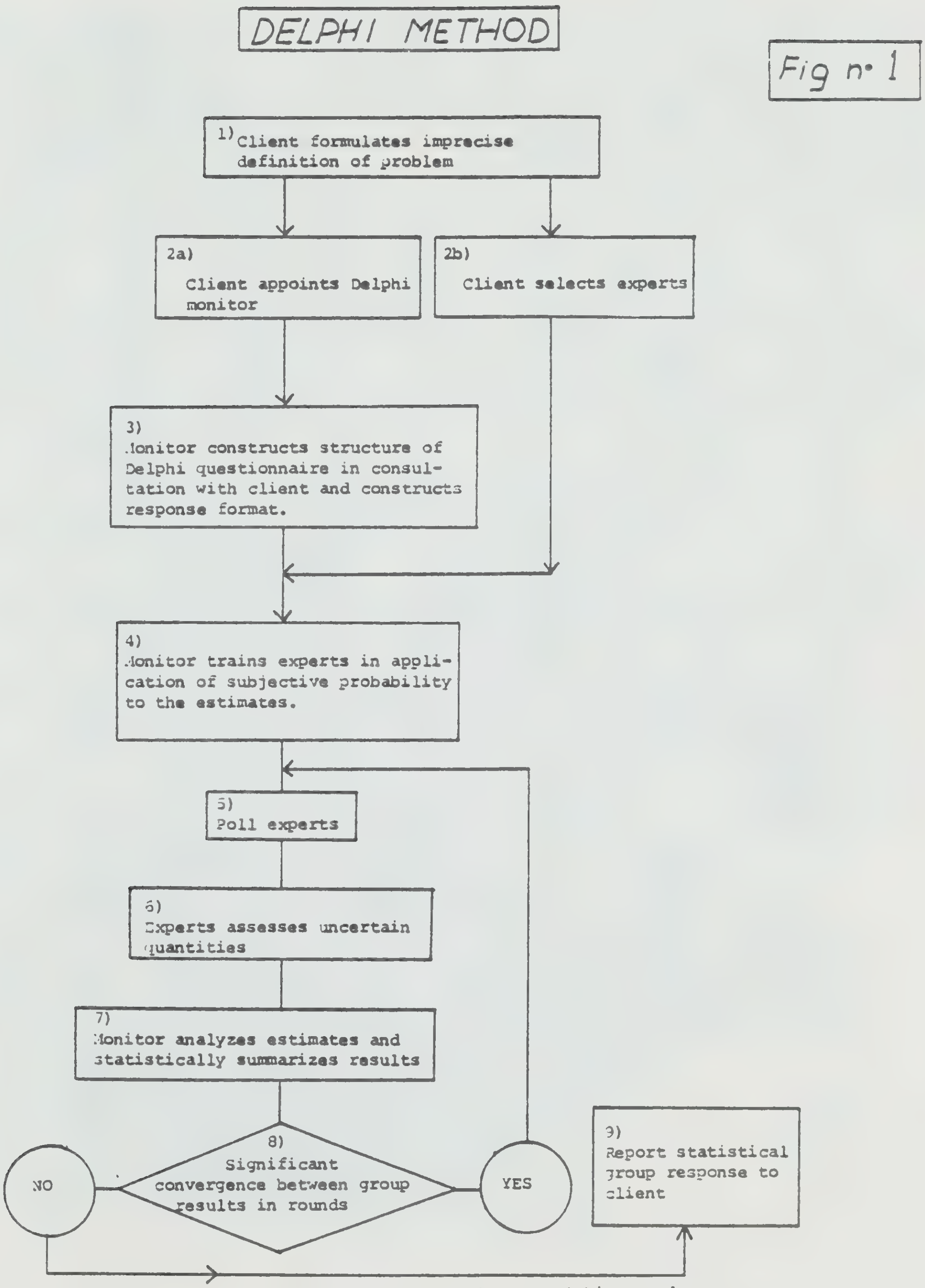


Figure 1 Diagram of pure Delphi procedure.

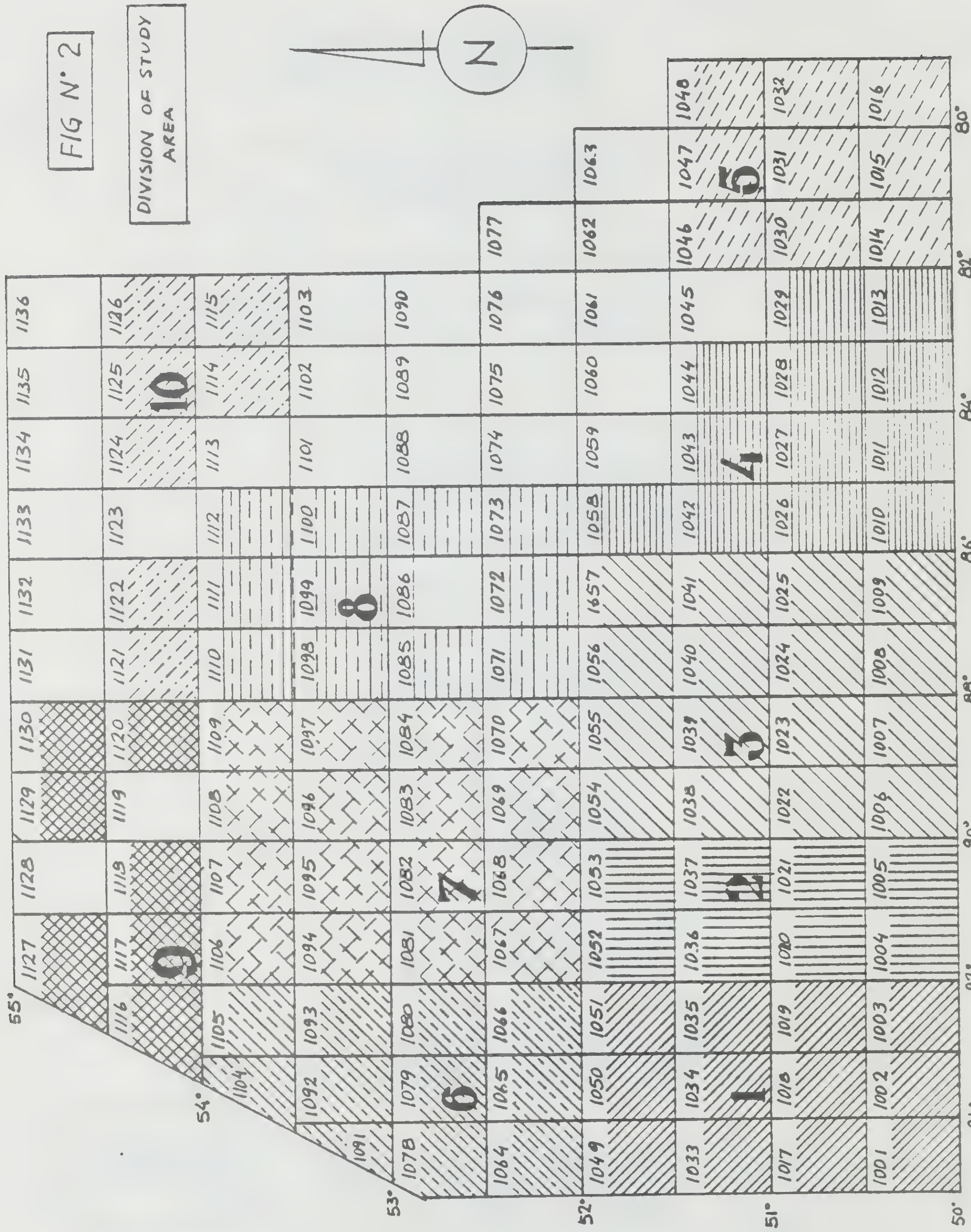


FIG N° 2

DIVISION OF STUDY AREA

LAT. & LONG. OF N.E. CORNER OF CELL

COPPER

M. Tons	GRADE % .5 → .9	1 → 2.9	3 → 5.0
.5 - 1			
1 - 5			
5 - 10			
10 - 25			
25-50			
50-100			
100-200			

Cu Zn

M. Tons	GRADE % 2.0 → 3.9	4.0 → 7.9	8.0 → 16.0
.5-1			
1-5			
5-10			
10-25			
25-50			
50-100			
100-200			

Cu Pb Zn

M. Tons	GRADE %		
.5-1			
1-5			
5-10			
10-25			
25-50			
50-100			
100-200			

Pb Zn

M. Tons	GRADE % 2.0 → 3.9	4.0 → 7.9	8.0 → 16.0
.5-1			
1-5			
5-10			
10-25			
25-50			
50-100			
100-200			

Ni Cu

M. Tons	GRADE %		
.5-1			
1-5			
5-10			
10-25			
25-50			
50-100			
100-200			

MOLYBDENUM

M. Tons	GRADE % .2 → .4	.5 → .9	1.0 → 2.0
.5-1			
1-5			
5-10			
10-25			
25-50			
50-100			
100-200			

URANIUM

M. Tons	GRADE lb/T 1.5 → 2.0	2.0 → 4.0	4.0 → 10.0
.5-1			
1-5			
6-10			
10-25			
25-50			
50-100			
100-200			

GOLD

M. Tons	GRADE oz/T .1 → .15	.16 → .25	.26 → .35
.5-1			
1-5			
5-10			
10-25			
25-50			
50-100			
100-200			

SILVER

M. Tons	GRADE oz/T 1 → 3	3.1 → 6	6.1 → 10
.5-1			
1-5			
5-10			
10-25			
25-50			
50-100			
100-200			

IRON

M. Tons	GRADE %		
.5-1			
1-5			
5-10			
10-25			
25-50			
50-100			
100-200			

Li Cb

M. Tons	GRADE %		
.5-1			
1-5			
5-10			
10-25			
25-50			
50-100			
100-200			

COAL

M. Tons	GRADE %		
.5-1			
1-5			
5-10			
10-25			
25-50			
50-100			
100-200			

N° of DEPOSITS	PROBABILITY
0	
1	
2	
3 - 5	
5 - 7	
7 - 9	
9 - 12	
12 - 15	

CHROMIUM

M. Tons	GRADE %		
.5-1			
1-5			
5-10			
10-25			
25-50			
50-100			
100-200			

DIAMONDS

M. Tons	GRADE $/T		
.5-1			
1-5			
5-10			
10-25			
25-50			
50-100			
100-200			

COBALT

M. Tons	GRADE %		
.5-1			
1-5			
5-10			
10-25			
25-50			
50-100			
100-200			

PLATINUM

M. Tons	GRADE oz/T		
.5-1			
1-5			
5-10			
10-25			
25-50			
50-100			
100-200			

Fig 3

THE QUESTIONNAIRE

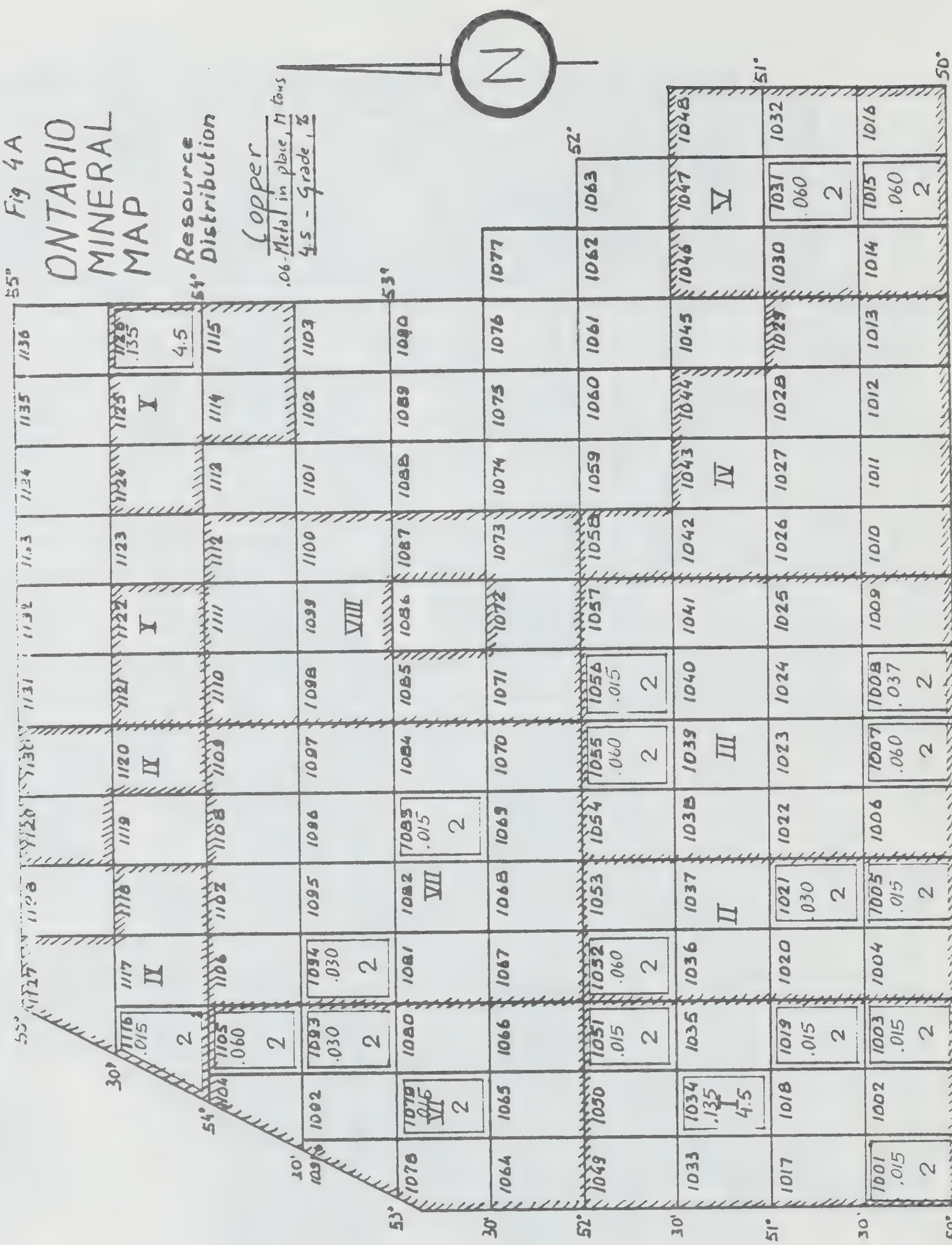


Fig 4A ONTARIO MINERAL MAP Resource Distribution

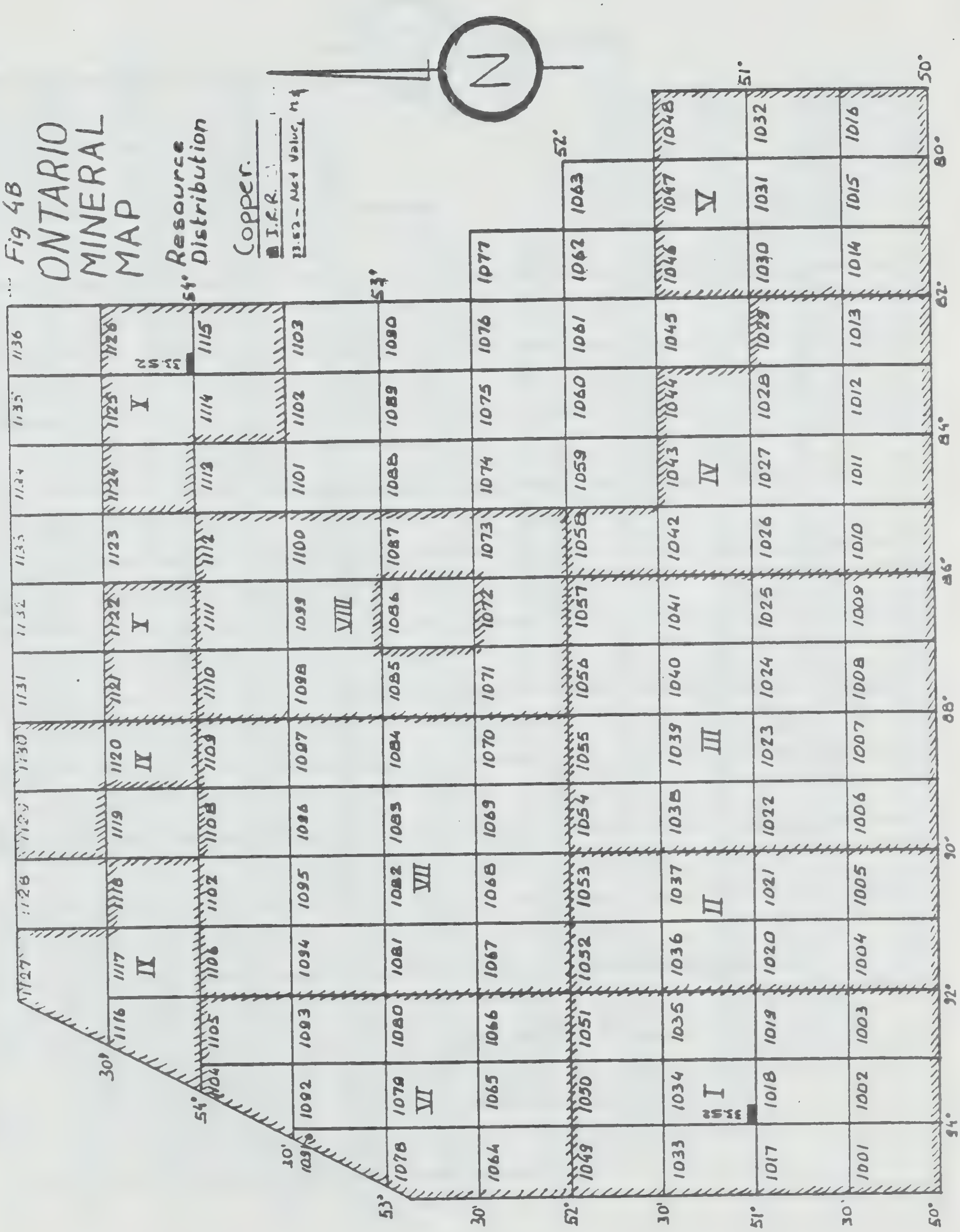


Fig 4B
ONTARIO
MINERAL
MAP
Resource
Distribution
Copper

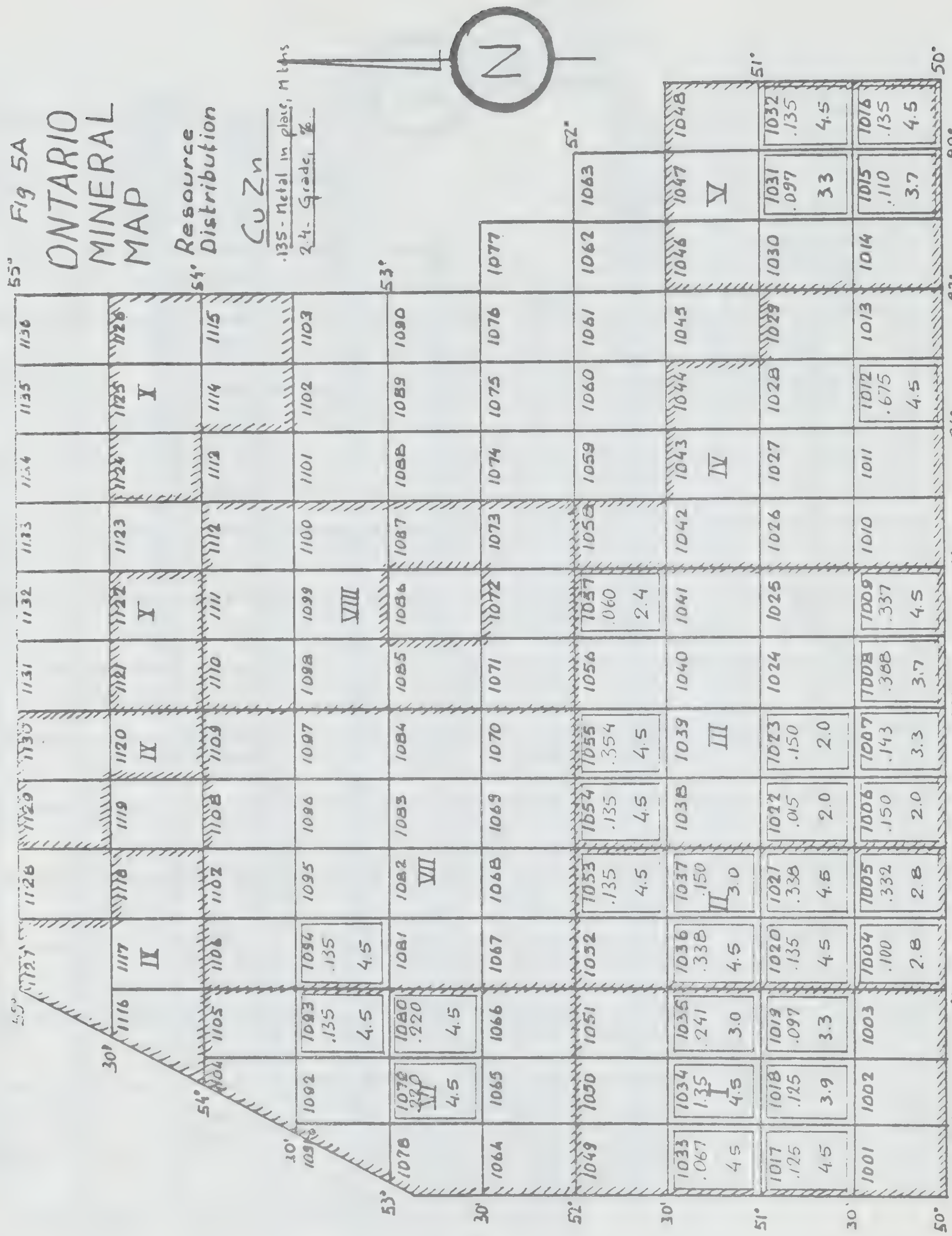


Fig 5A
ONTARIO
MINERAL
MAP
Resource
Distribution
Cu Zn
.135 - Metal in place, M tons
2.4 - Grade, %

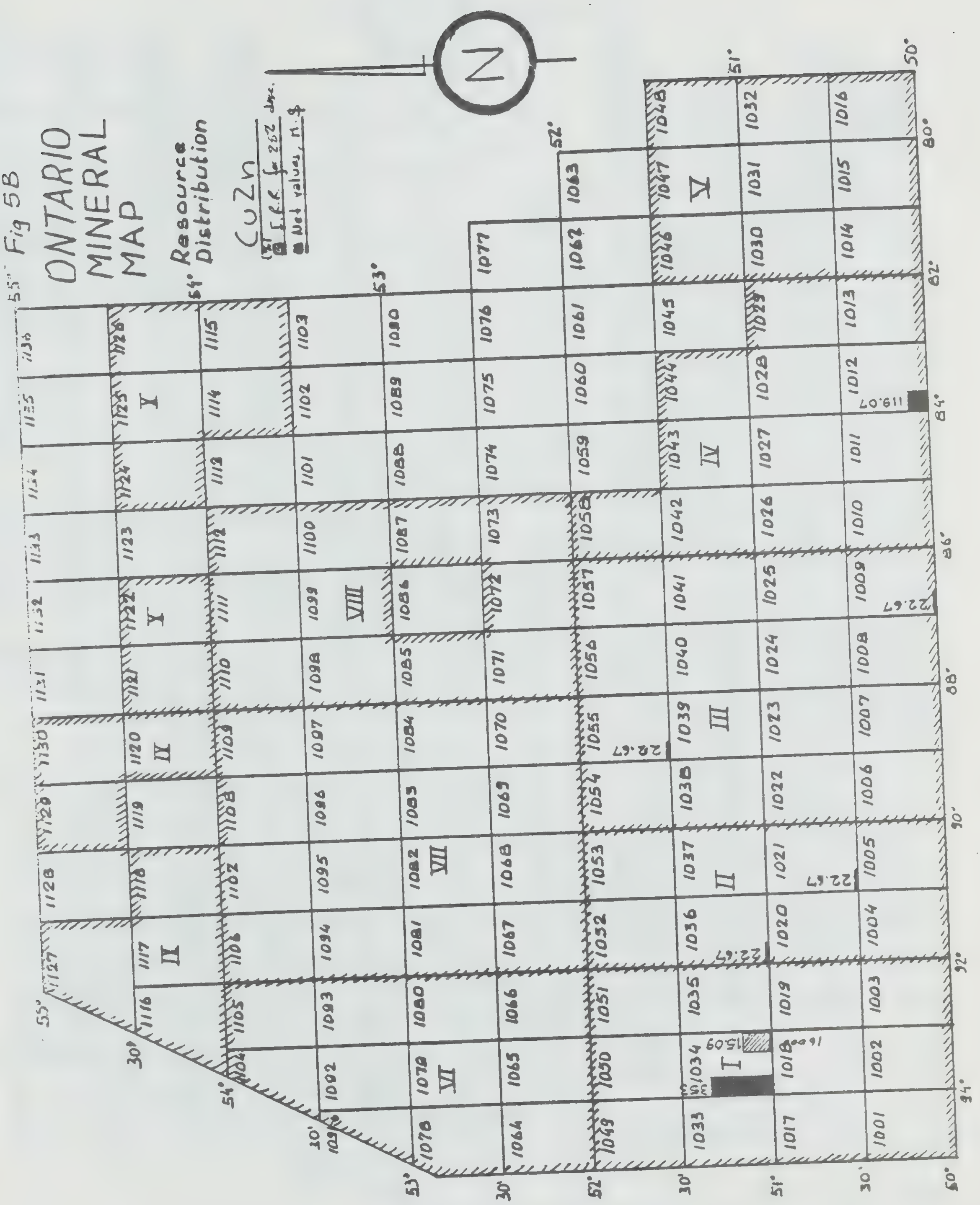


Fig 5B
ONTARIO
MINERAL
MAP
Resource
Distribution
CuZn
N

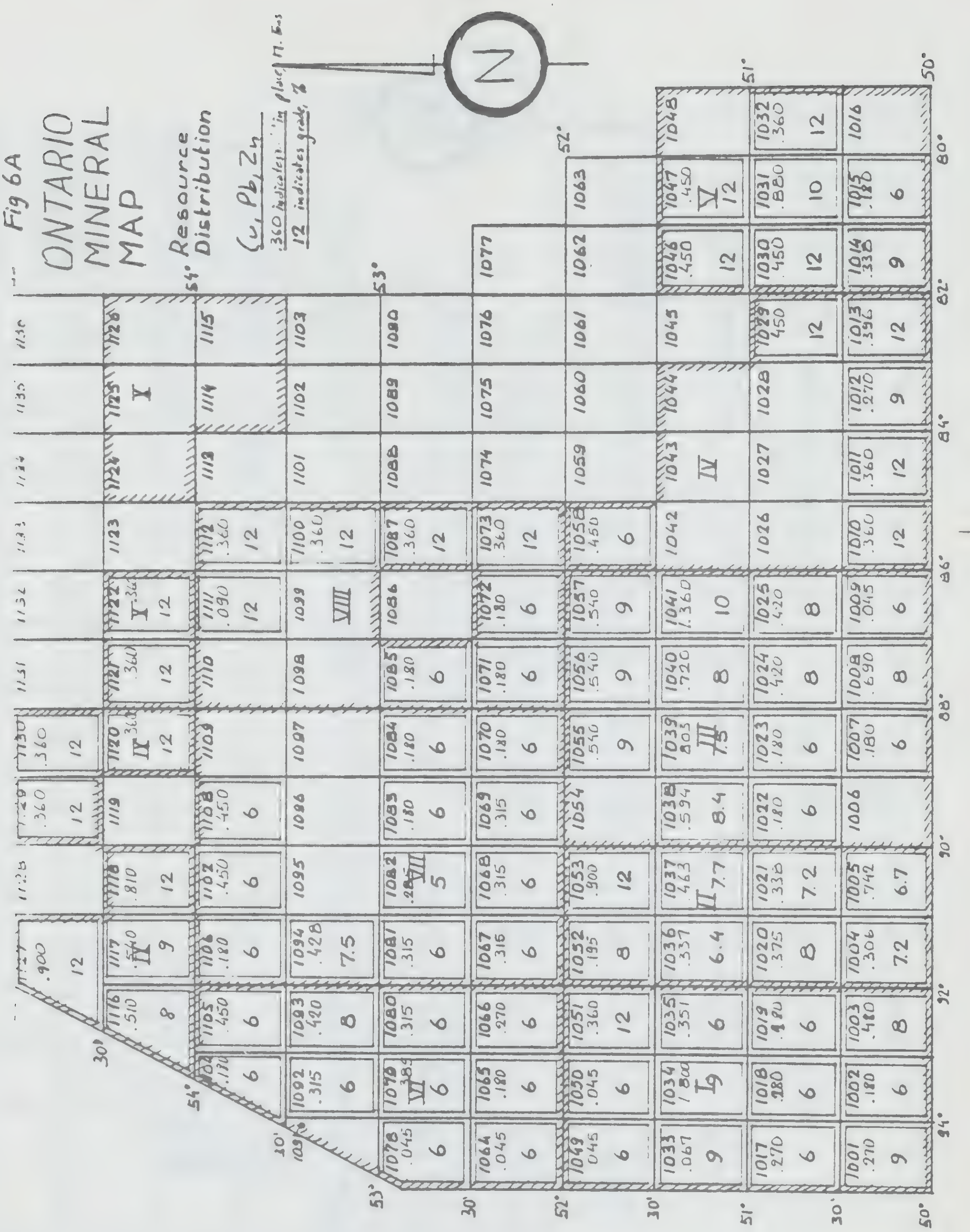


Fig 6A
ONTARIO MINERAL MAP
Resource Distribution
Cu, Pb, Zn

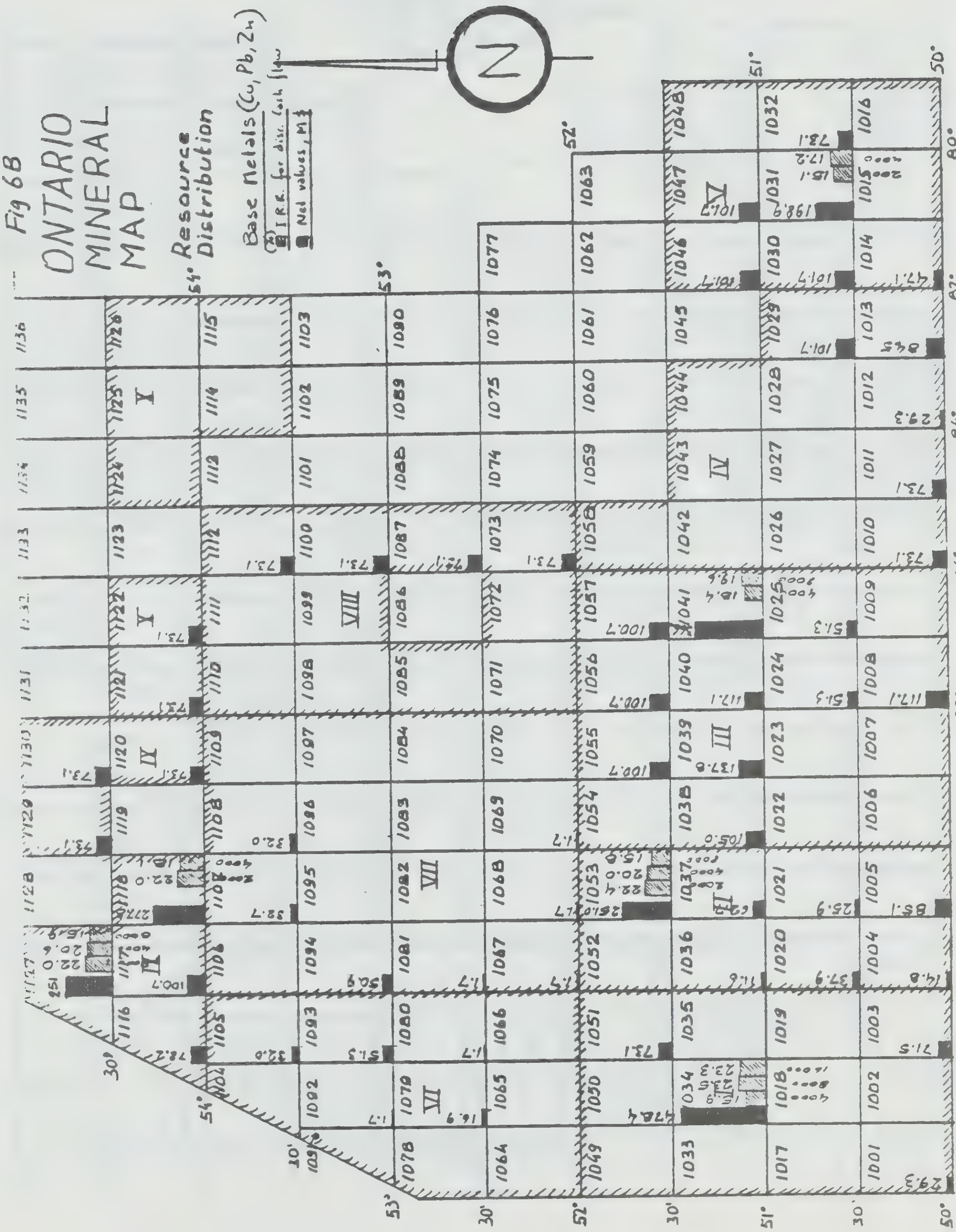


Fig 6B
ONTARIO MINERAL MAP
Resource Distribution
Base Metals (Cu, Pb, Zn)
I.R.R. for disc. Cash flow
Net values, M$
N

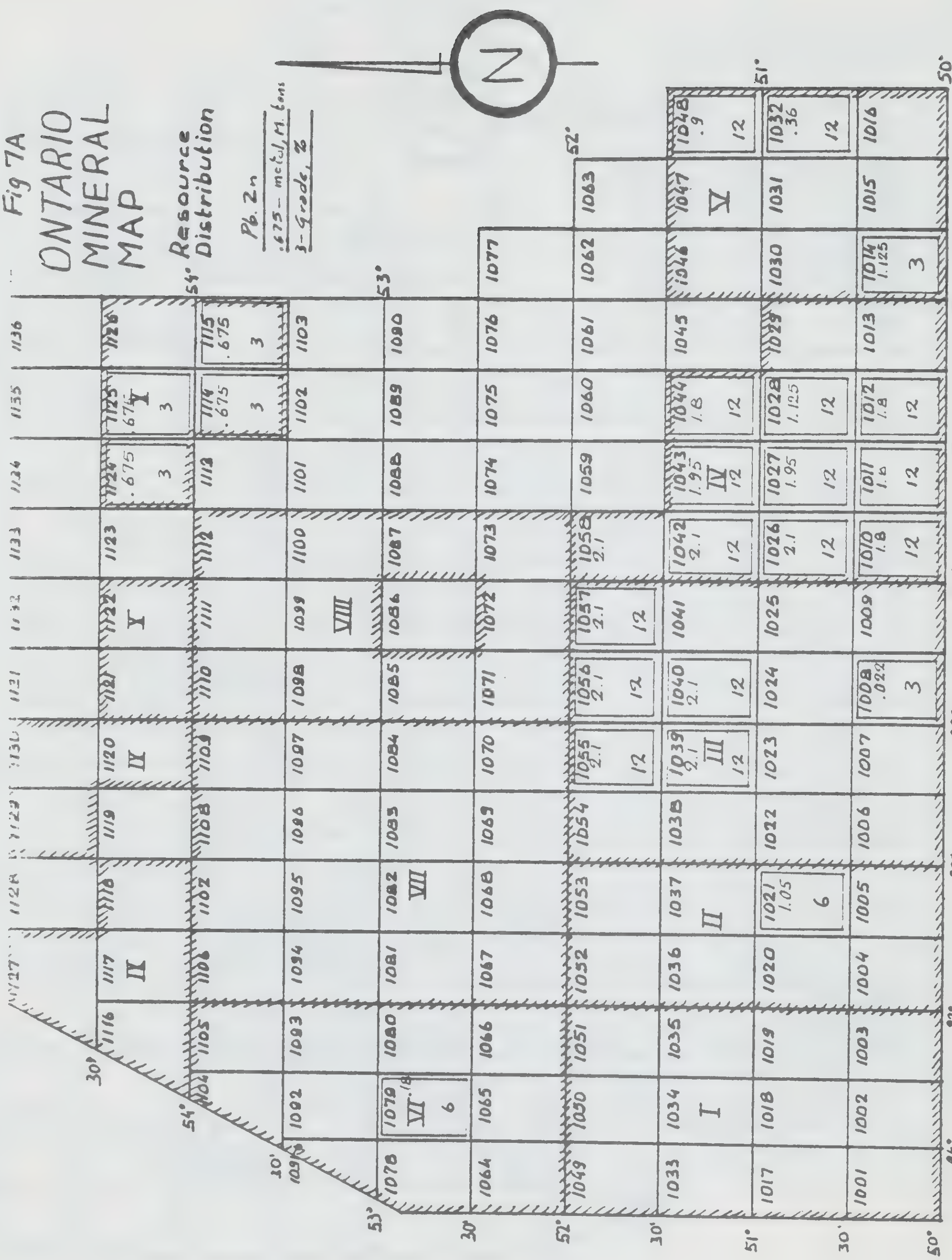


Fig 7A
ONTARIO
MINERAL
MAP
Resource
Distribution
Pb. Zn
.675 - metal, M. tons
3 - Grade, %

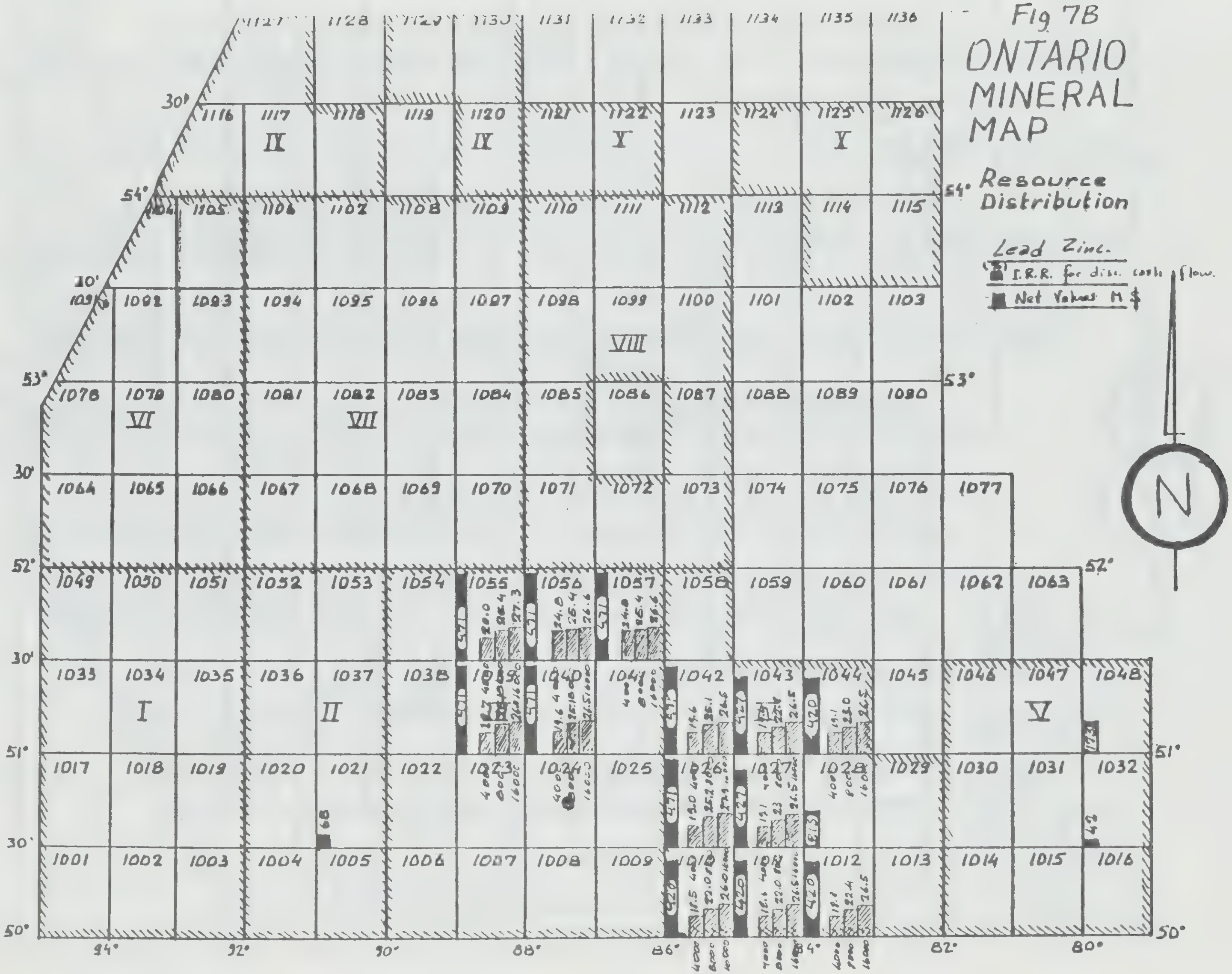


Fig 7B
ONTARIO MINERAL MAP
Resource Distribution

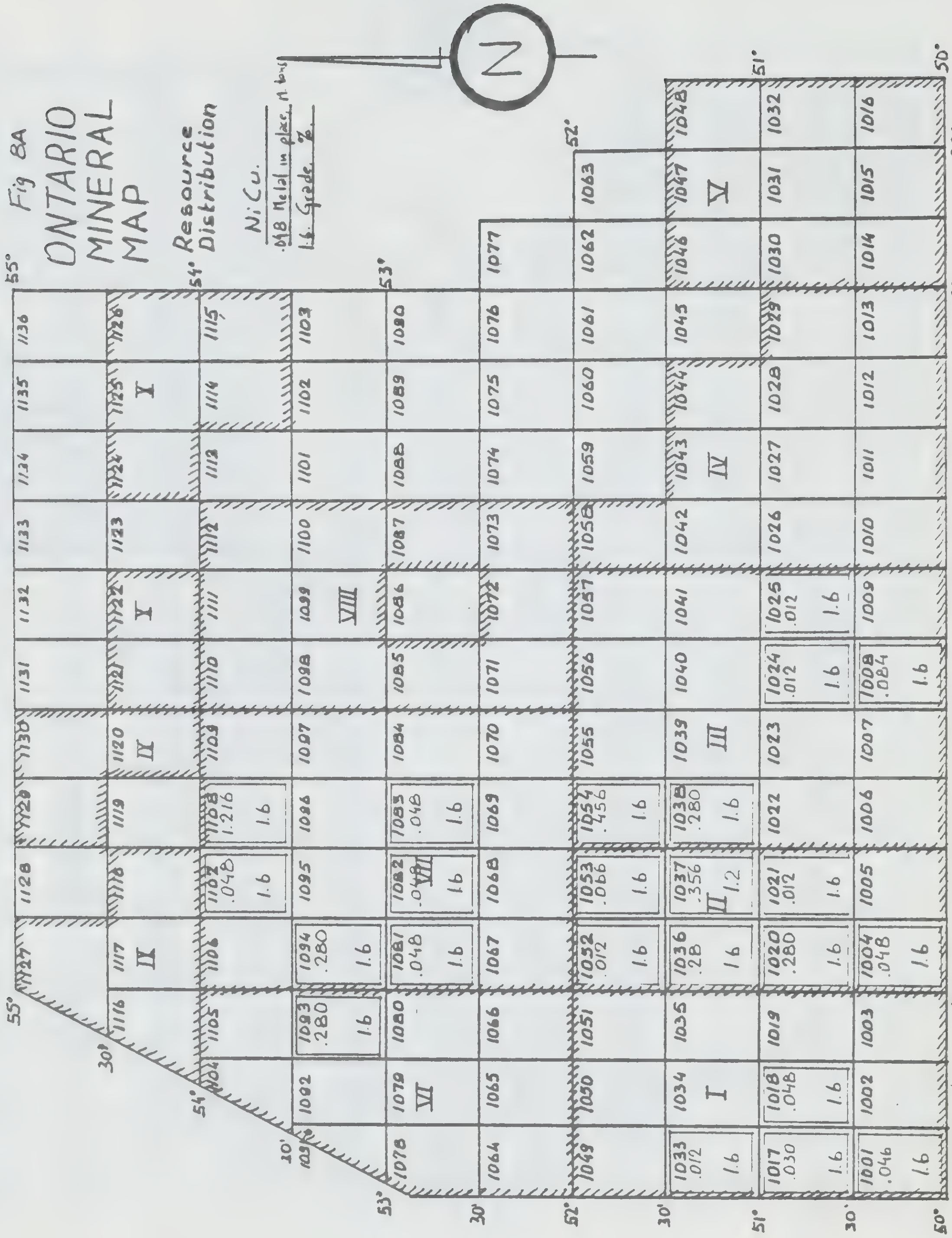


Fig 8A
ONTARIO MINERAL MAP
Resource Distribution
Ni:Cu.
.048 Metal in place, m. tons
1.6 Grade %
N

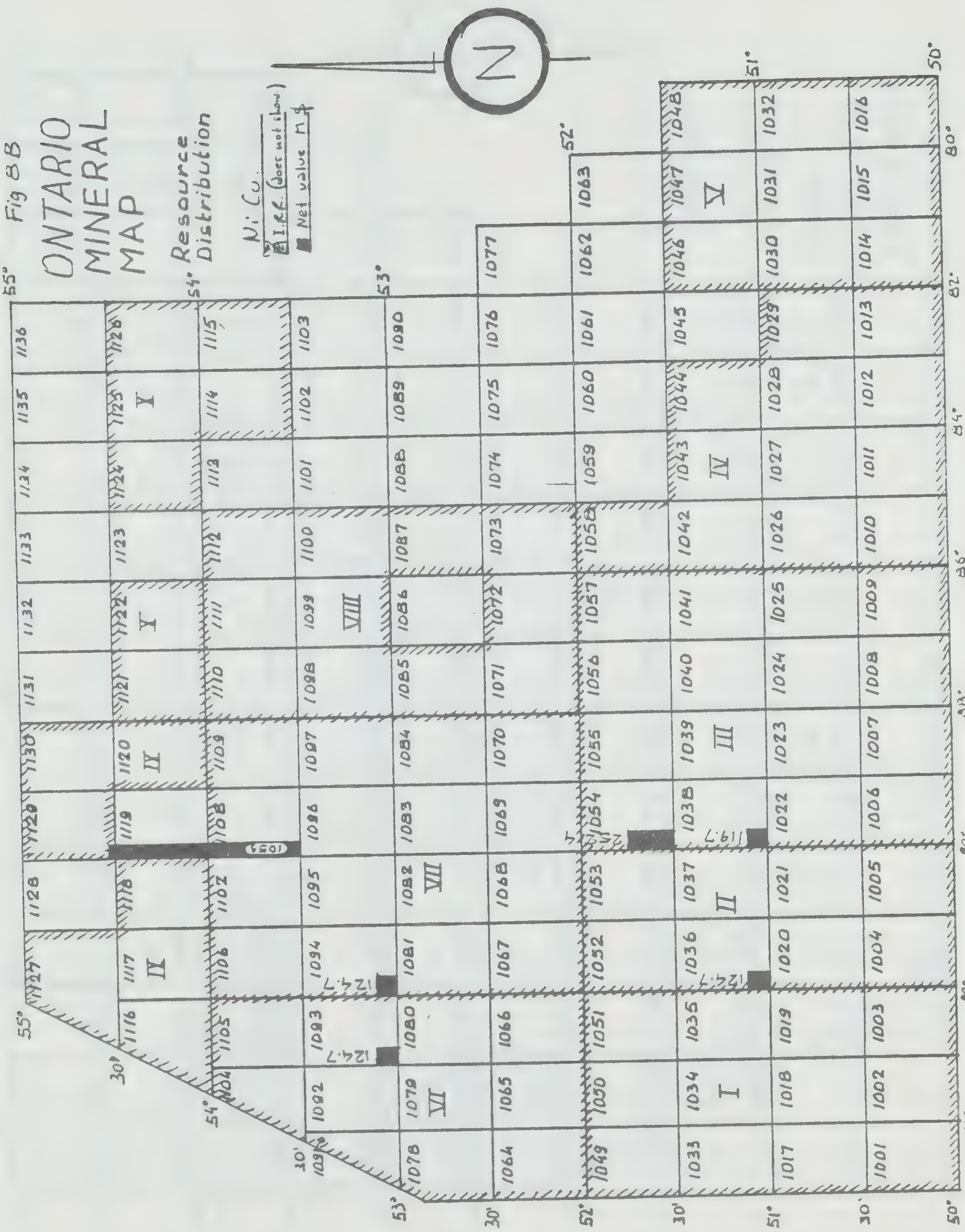


Fig 8B
ONTARIO
MINERAL
MAP
Resource
Distribution
Ni Cu
I.R.R. (does not show)
Net value M $
N

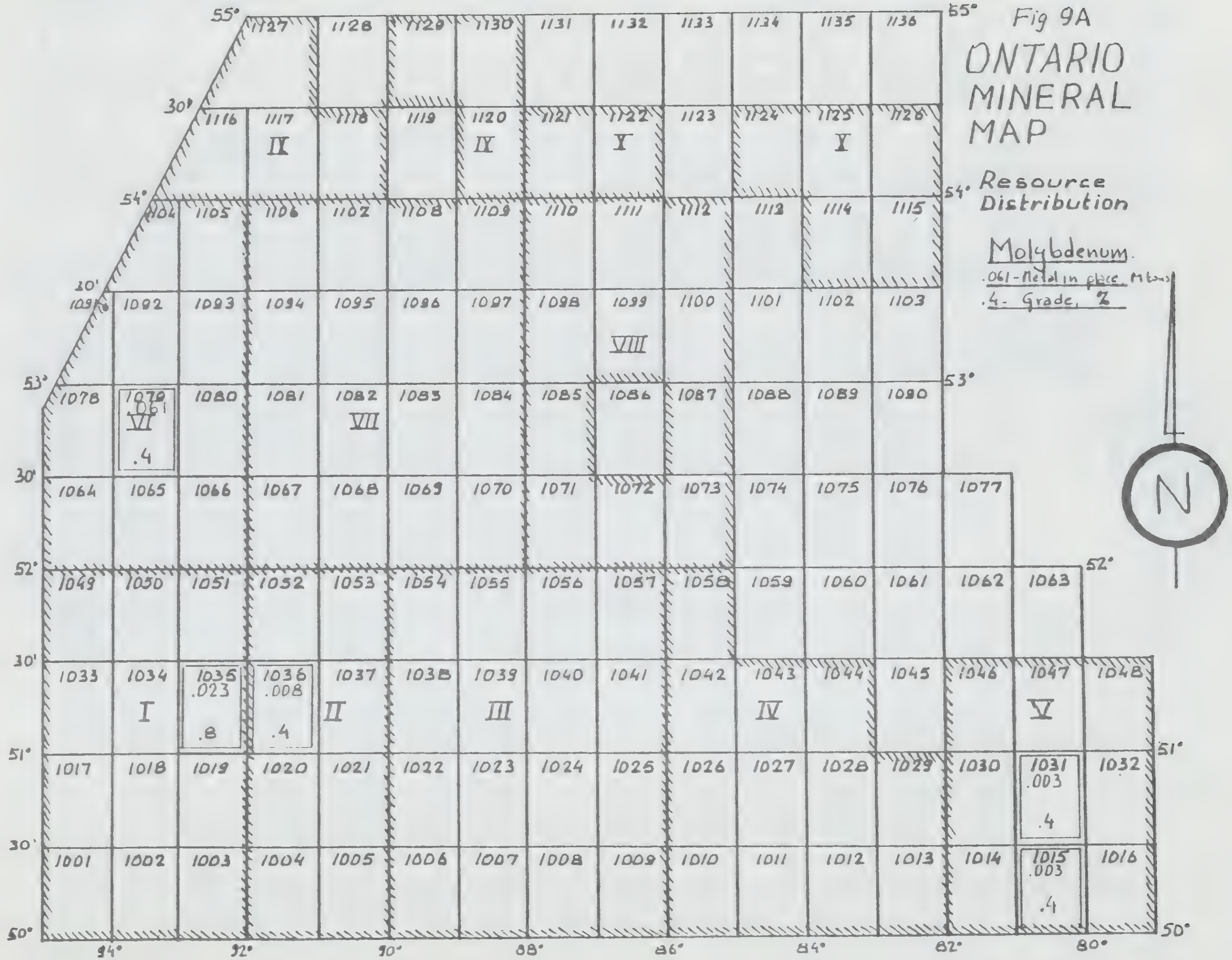


Fig 9A
ONTARIO MINERAL MAP

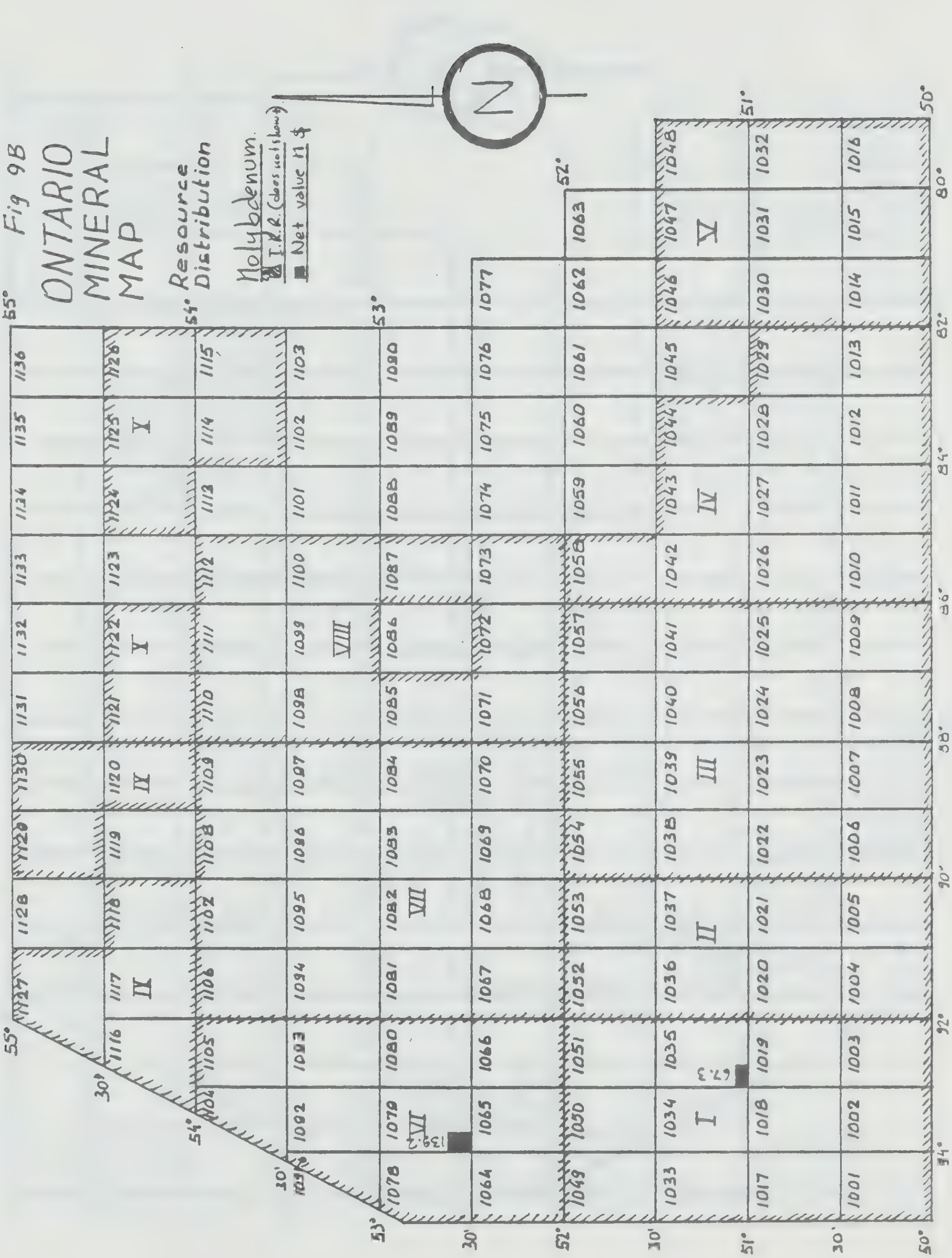


Fig 9B
ONTARIO
MINERAL
MAP
Resource
Distribution
Molybdenum
Net value M $
139.2
67.3

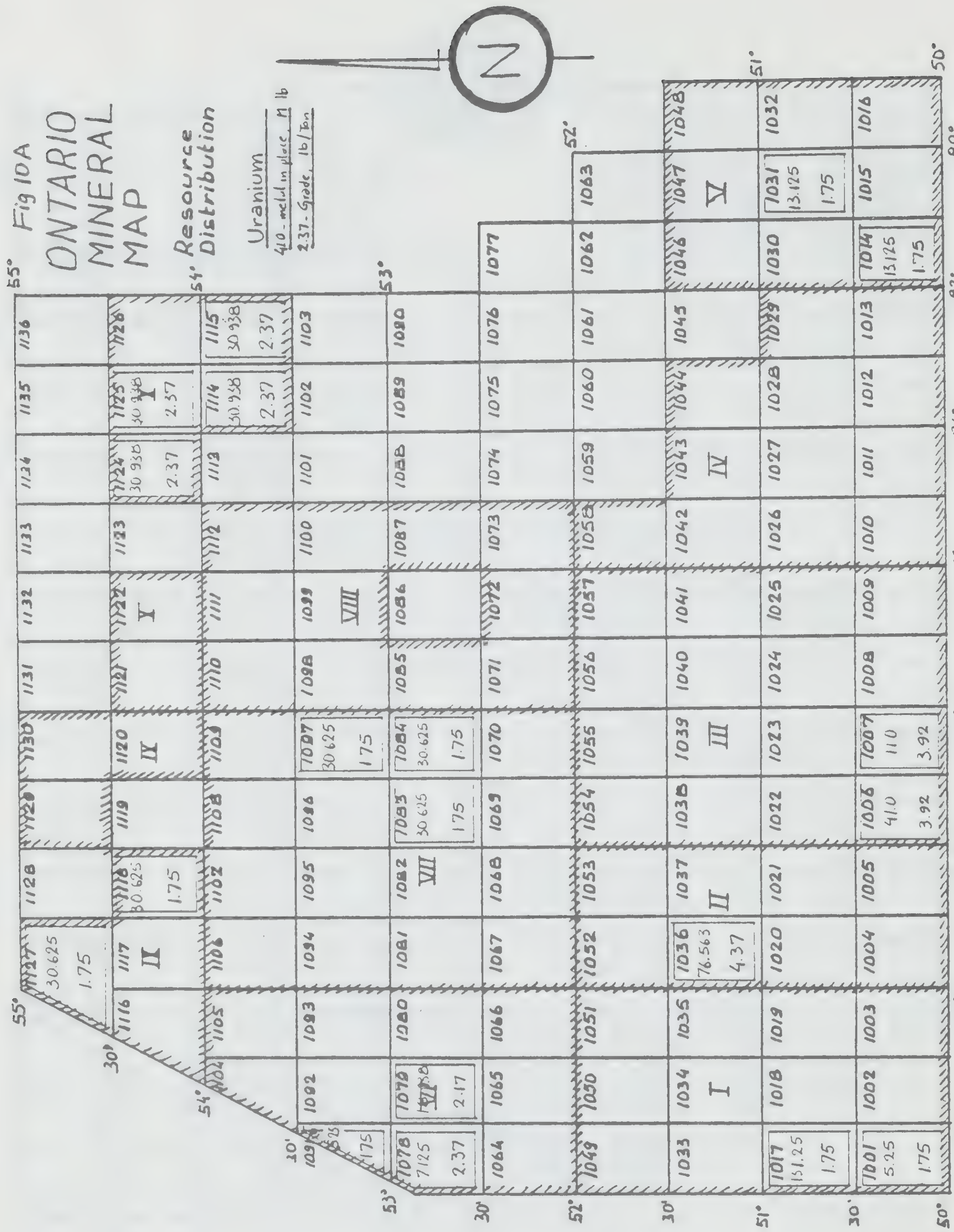


Fig 10A
ONTARIO MINERAL MAP
Resource Distribution
Uranium
410 - metal in place, M lb
2.37 - Grade, lb/Ton

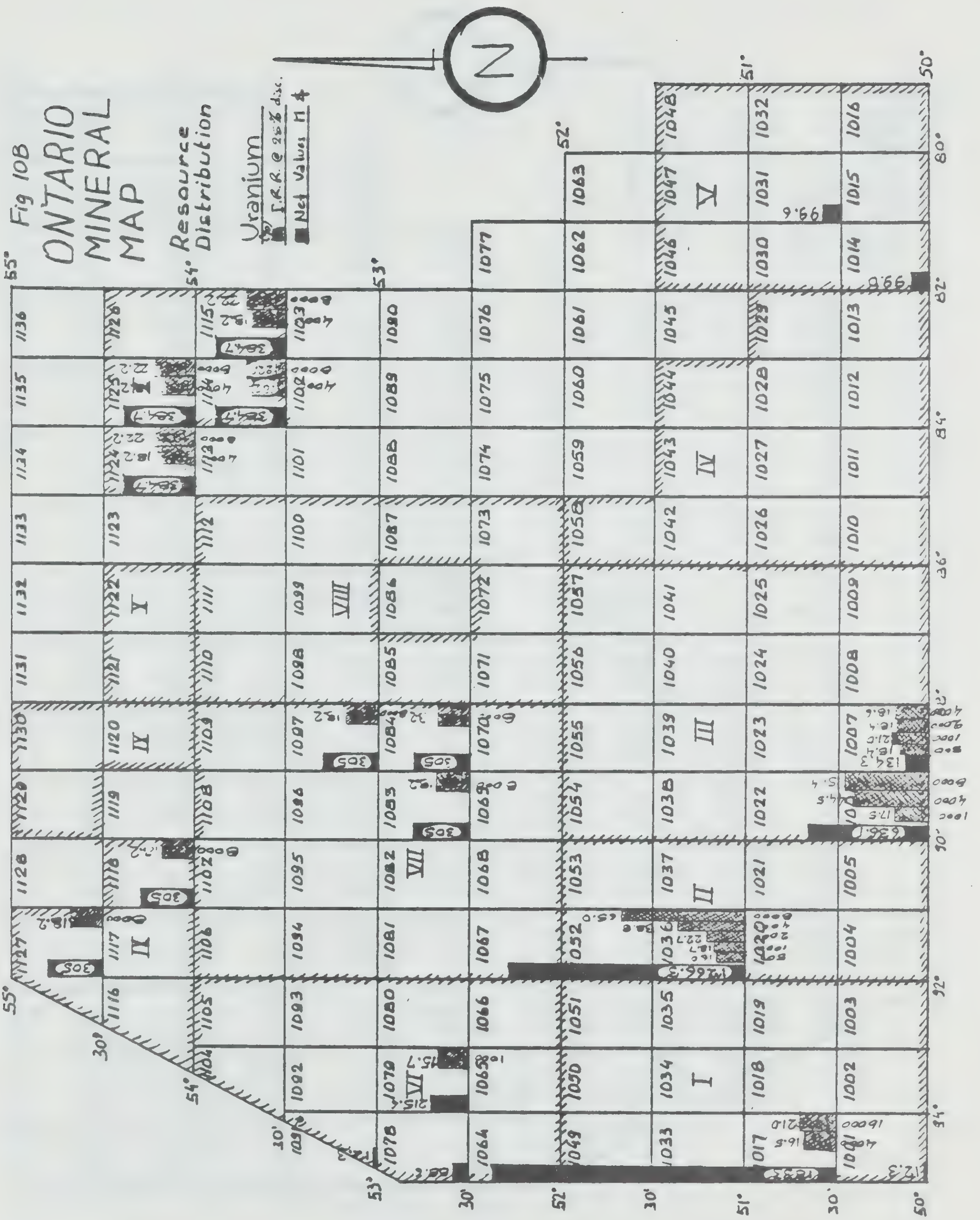


Fig 10B
ONTARIO
MINERAL
MAP
Resource
Distribution
Uranium
I.R.R. @ 25% disc.
Net Values M $

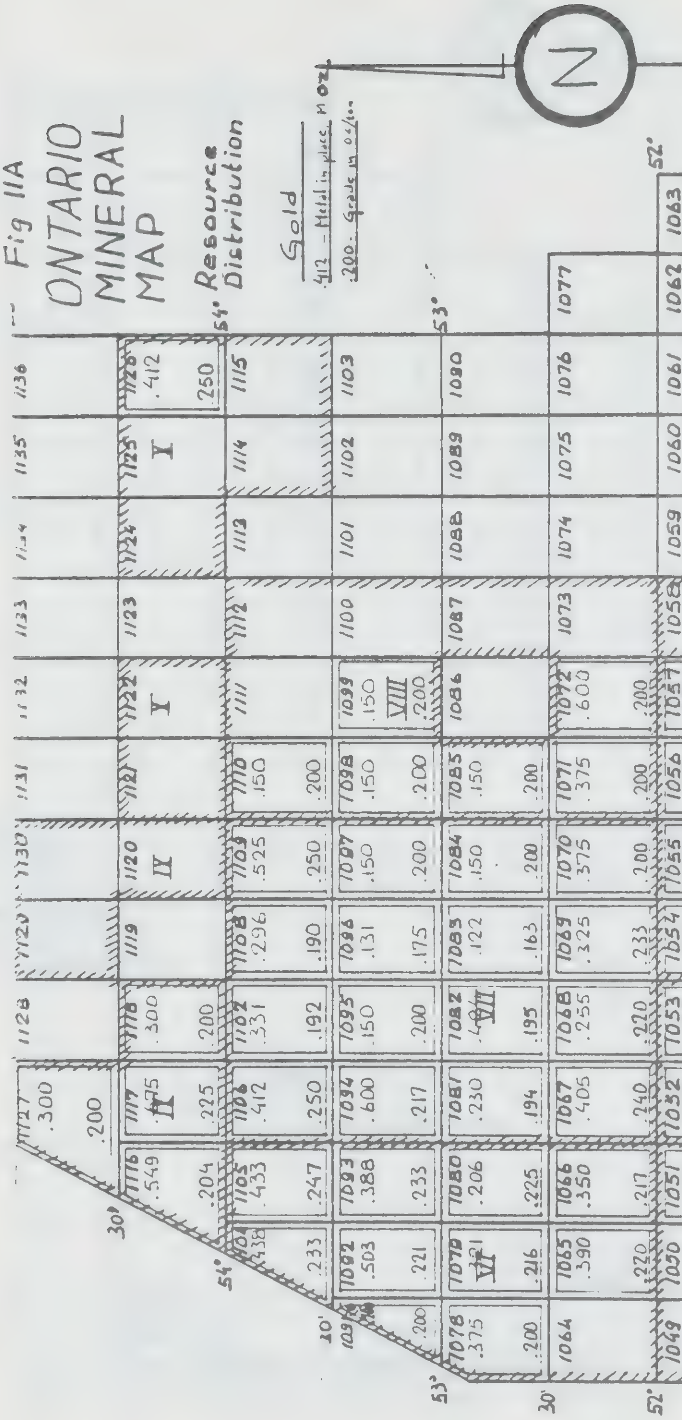


Fig 11A
ONTARIO MINERAL MAP
Resource Distribution
Gold

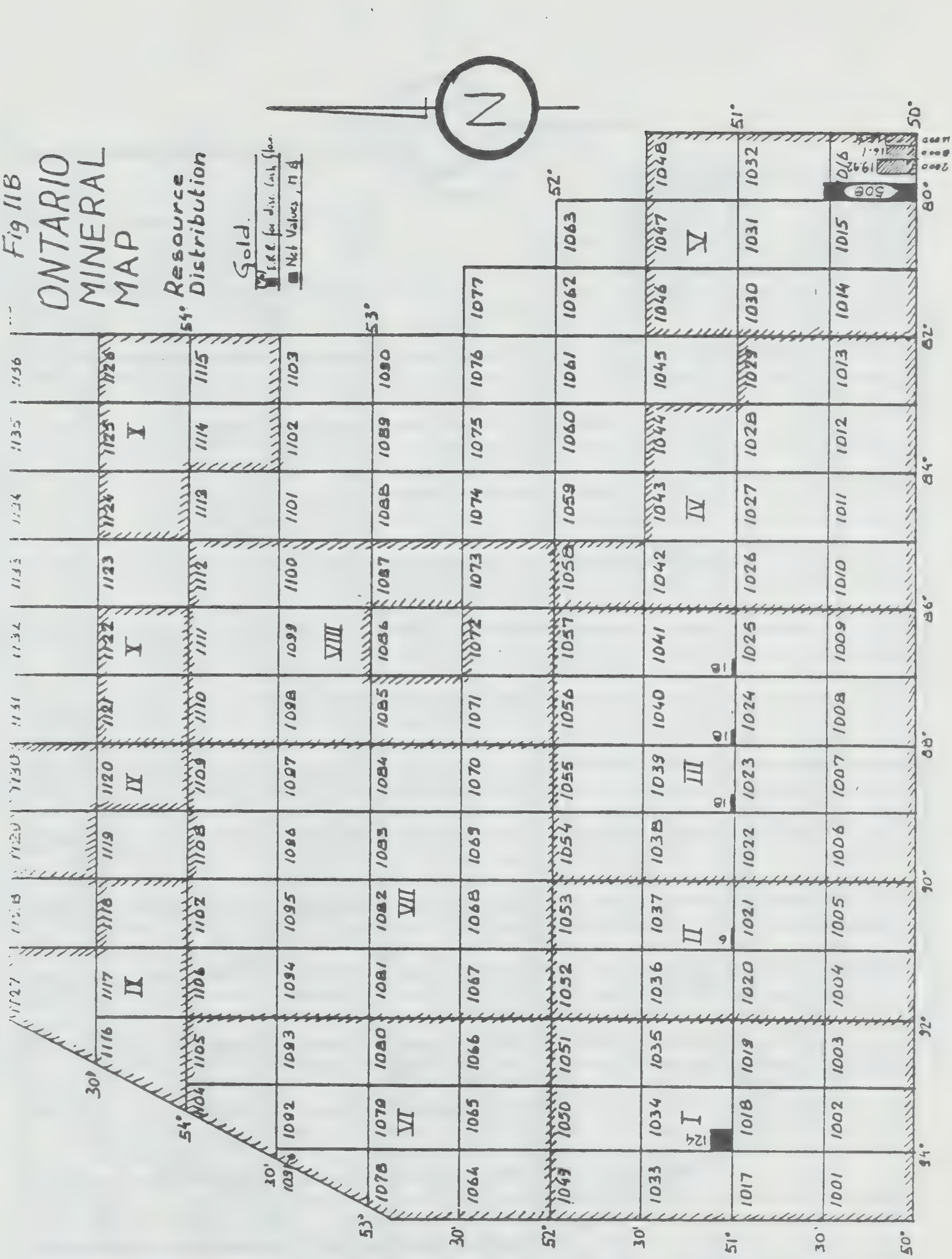


Fig 11B
ONTARIO
MINERAL
MAP
Resource
Distribution
Gold.

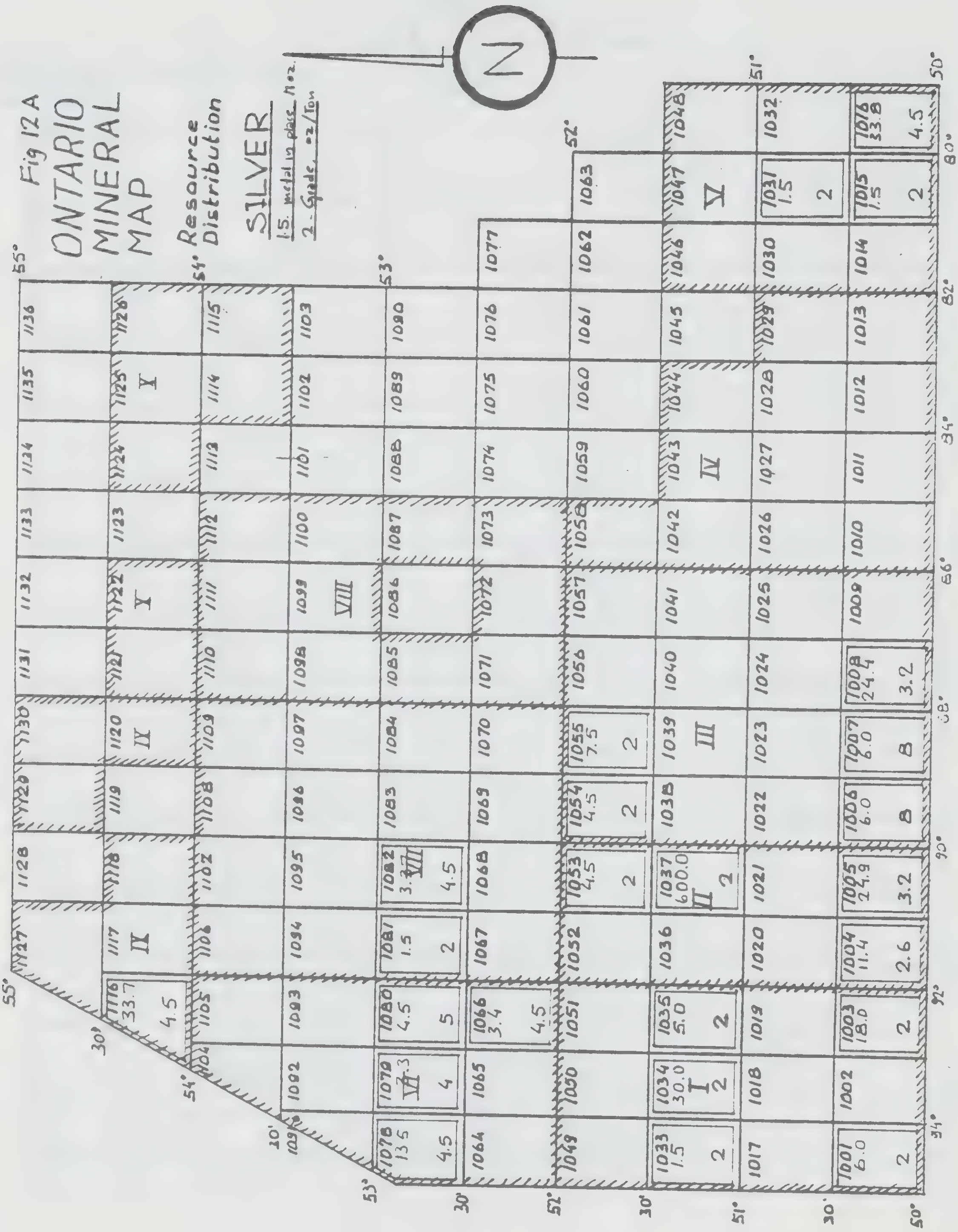


Fig 12 A
ONTARIO
MINERAL
MAP
Resource
Distribution
SILVER
1.5 metal in place, M oz.
2 - Grade, oz/Ton

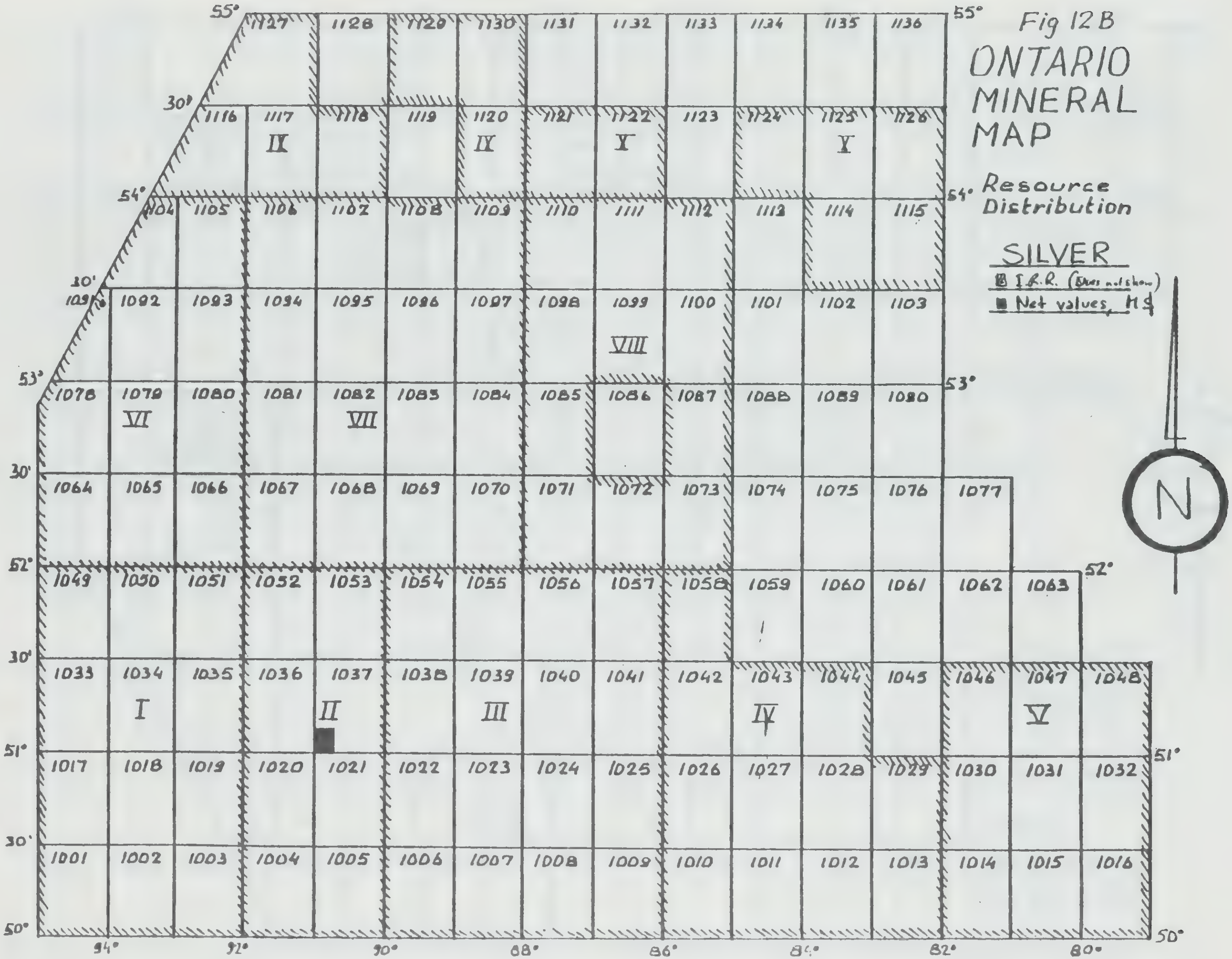


Fig 12 B
ONTARIO MINERAL MAP
Resource Distribution
SILVER
Net values, M$

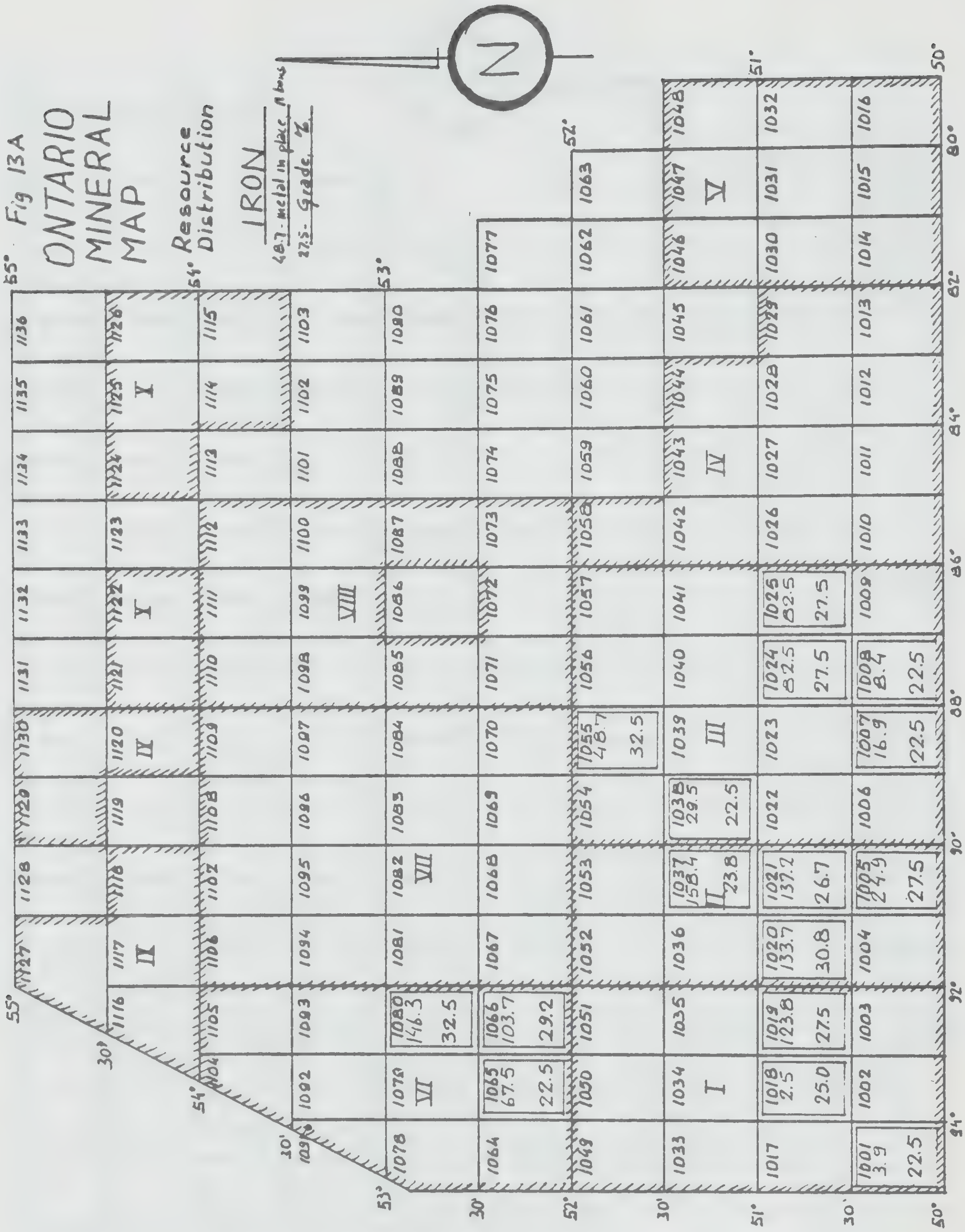


Fig 13A
ONTARIO MINERAL MAP
Resource Distribution
IRON
48.7 - metal in place, M tons
27.5 - Grade, %
N

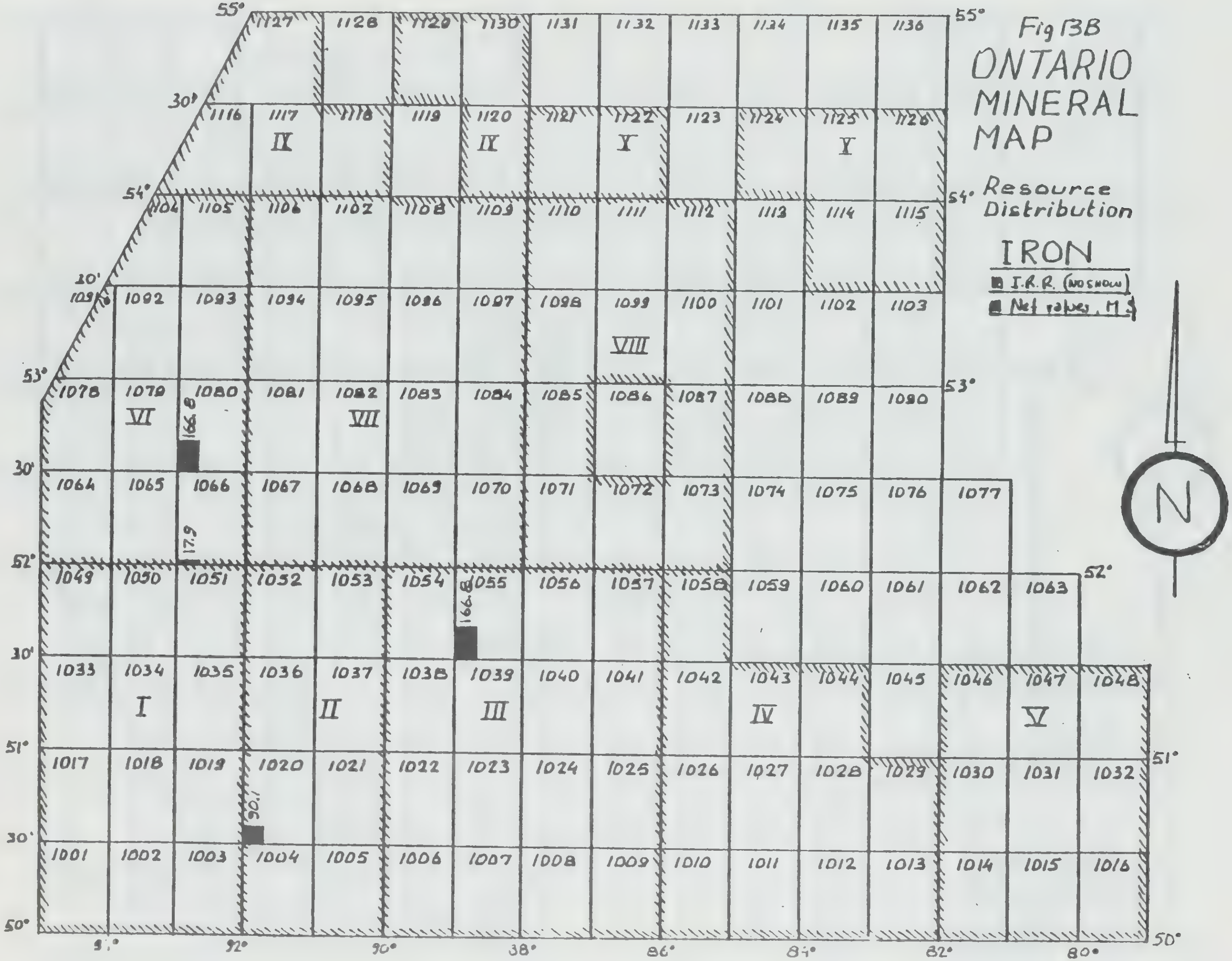


Fig 13B
ONTARIO
MINERAL
MAP
Resource
Distribution
IRON
166.8
17.9
90.1

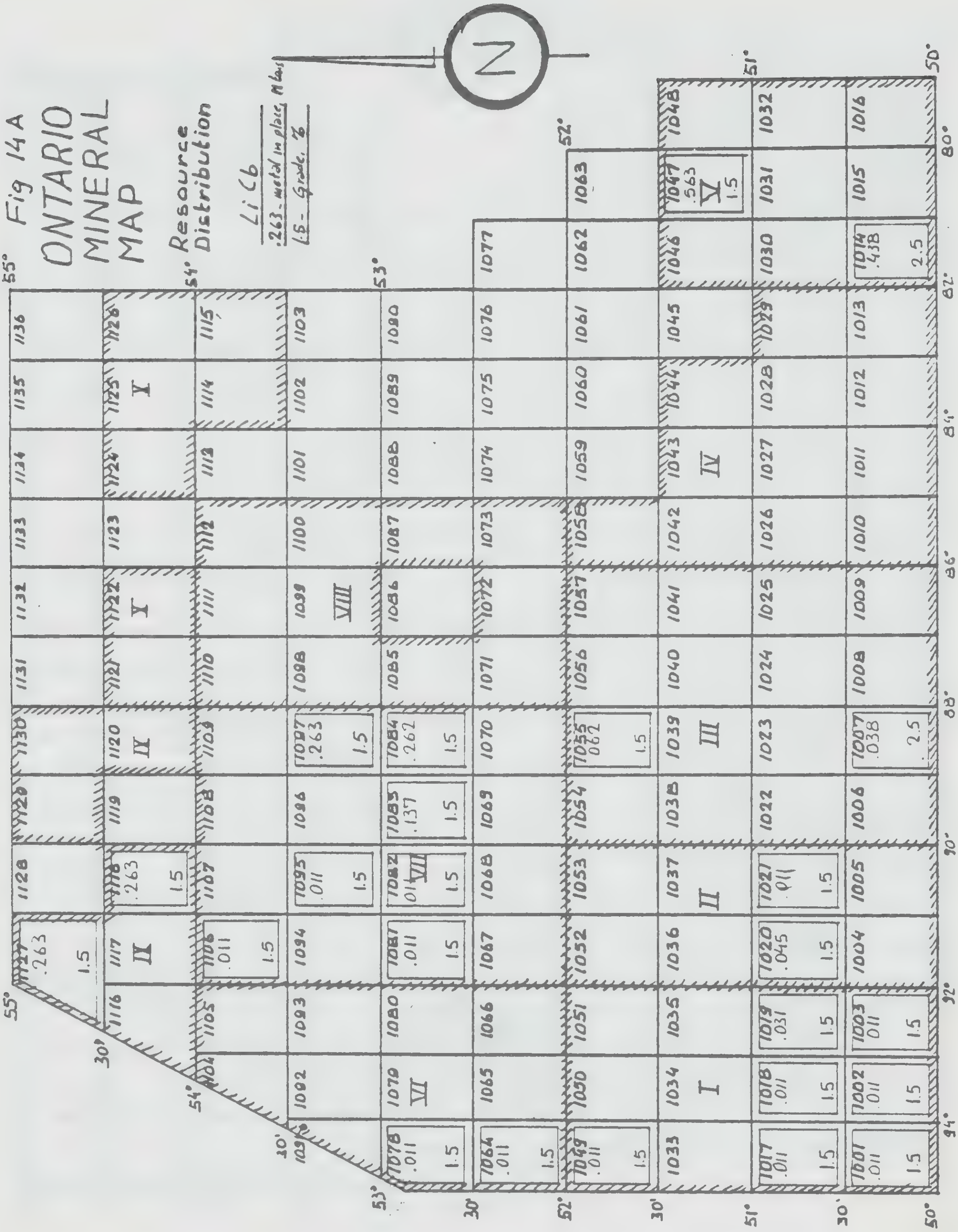


Fig 14A
ONTARIO
MINERAL
MAP
Resource
Distribution
Li Cb
.263 - metal in place, M tons
1.5 - Grade, %

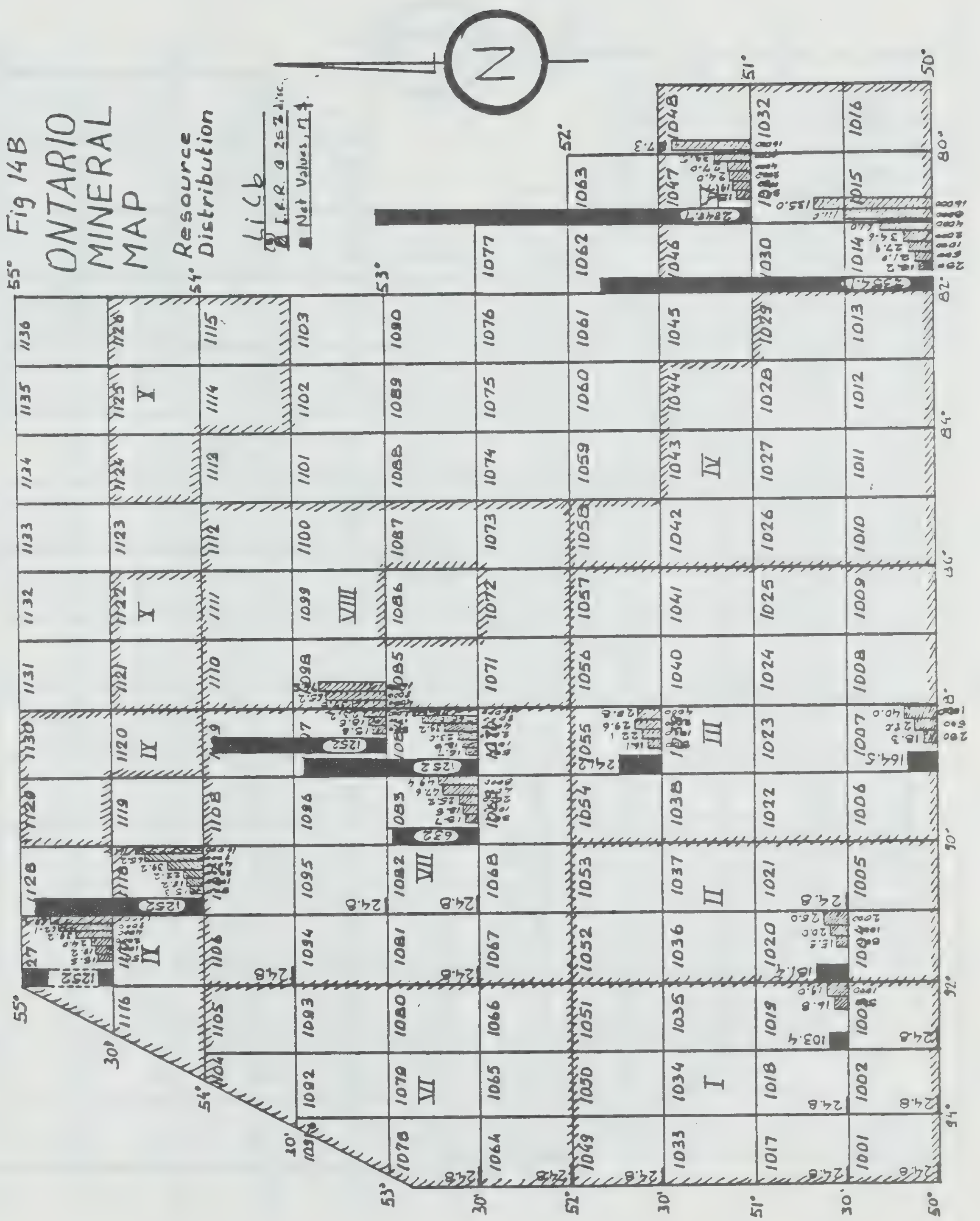


Fig 14B
ONTARIO MINERAL MAP
Resource Distribution
Li Cb
I.E.R. @ 25% disc.
Net Values, M $

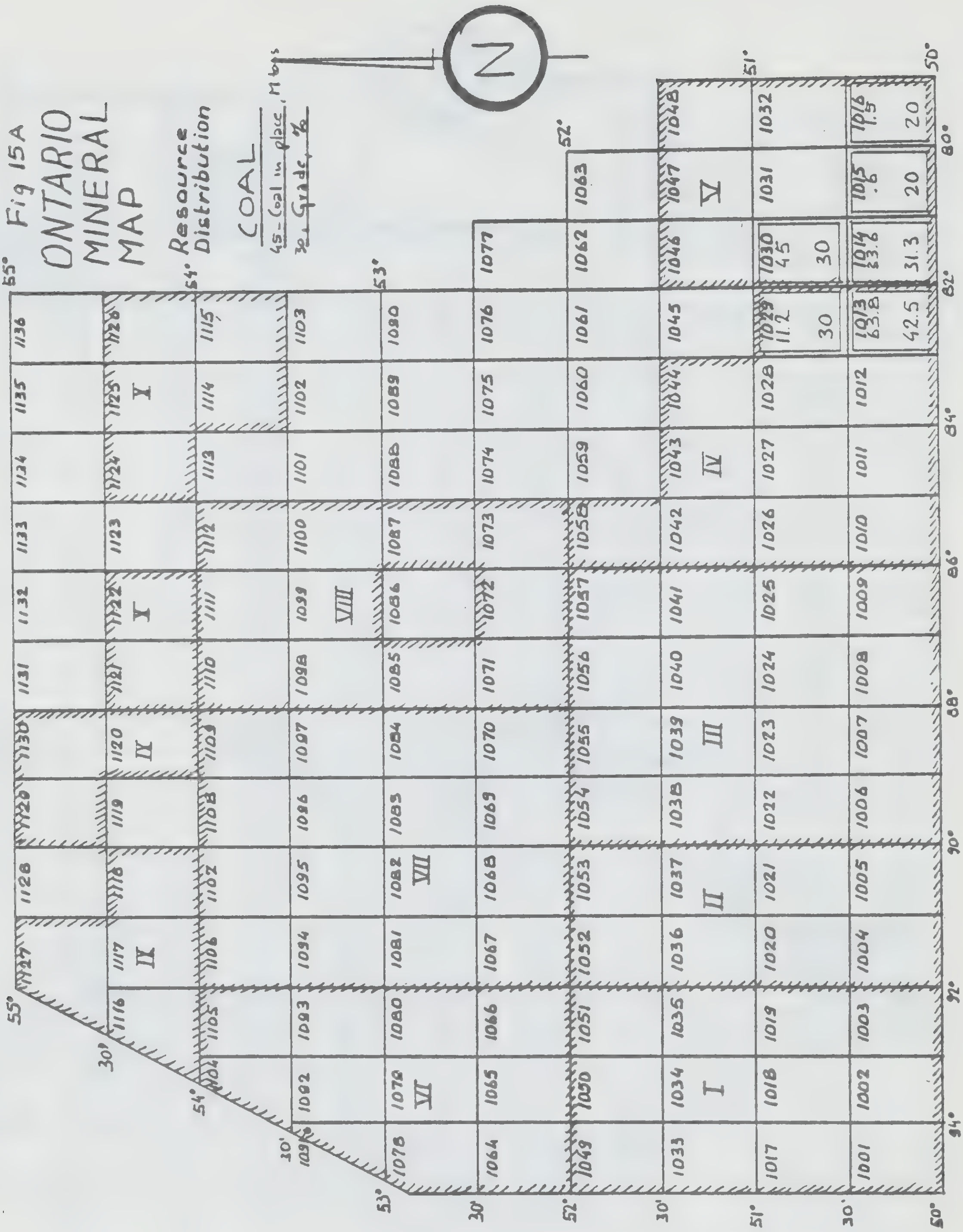


Fig 15A
ONTARIO MINERAL MAP
Resource Distribution
COAL
45 - Coal in place, M tons
30 - Grade, %

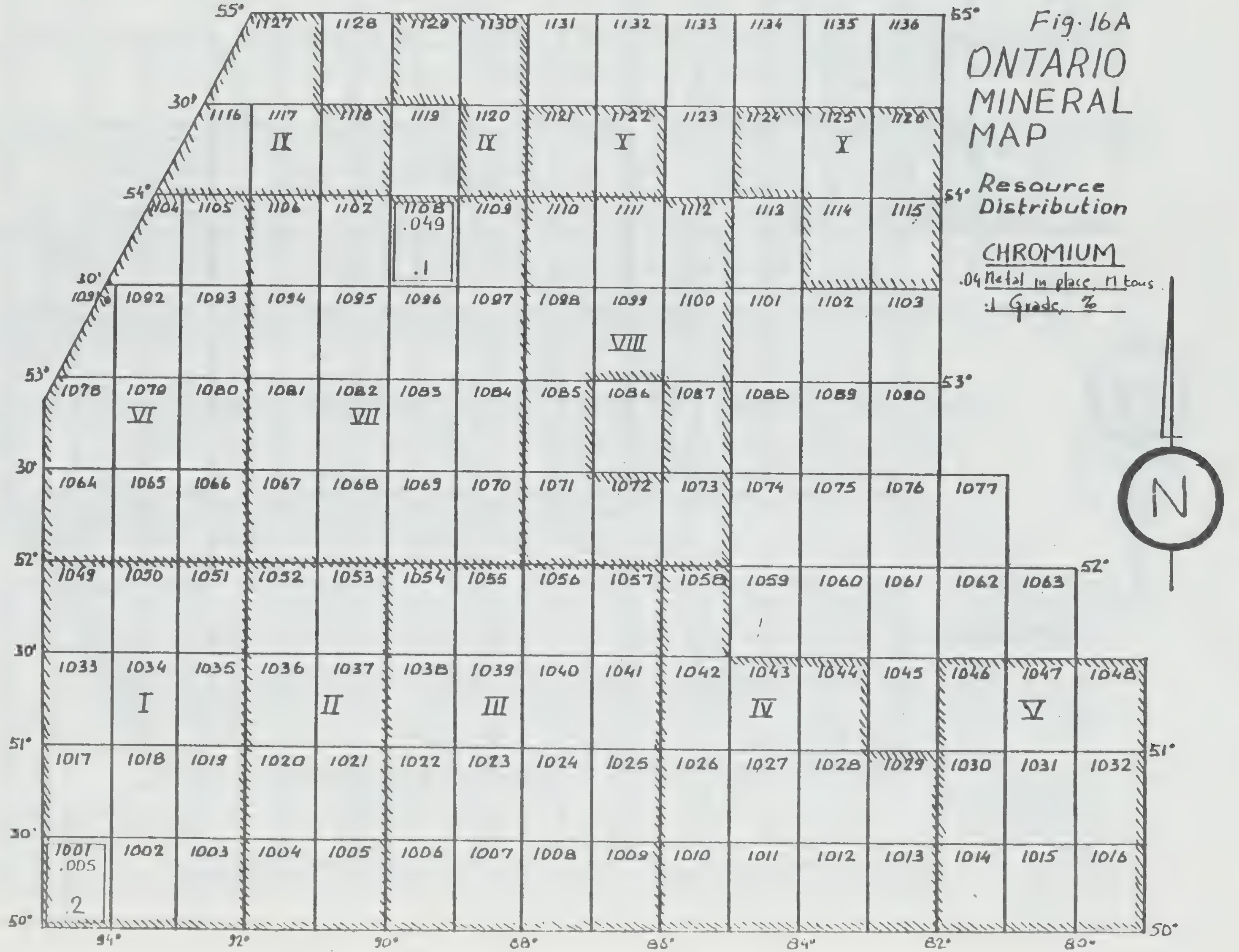


Fig. 16A
ONTARIO
MINERAL
MAP
Resource
Distribution
CHROMIUM
.04 Metal in place, M tons
:1 Grade, %
1108
.049
.1
1001
.005
.2

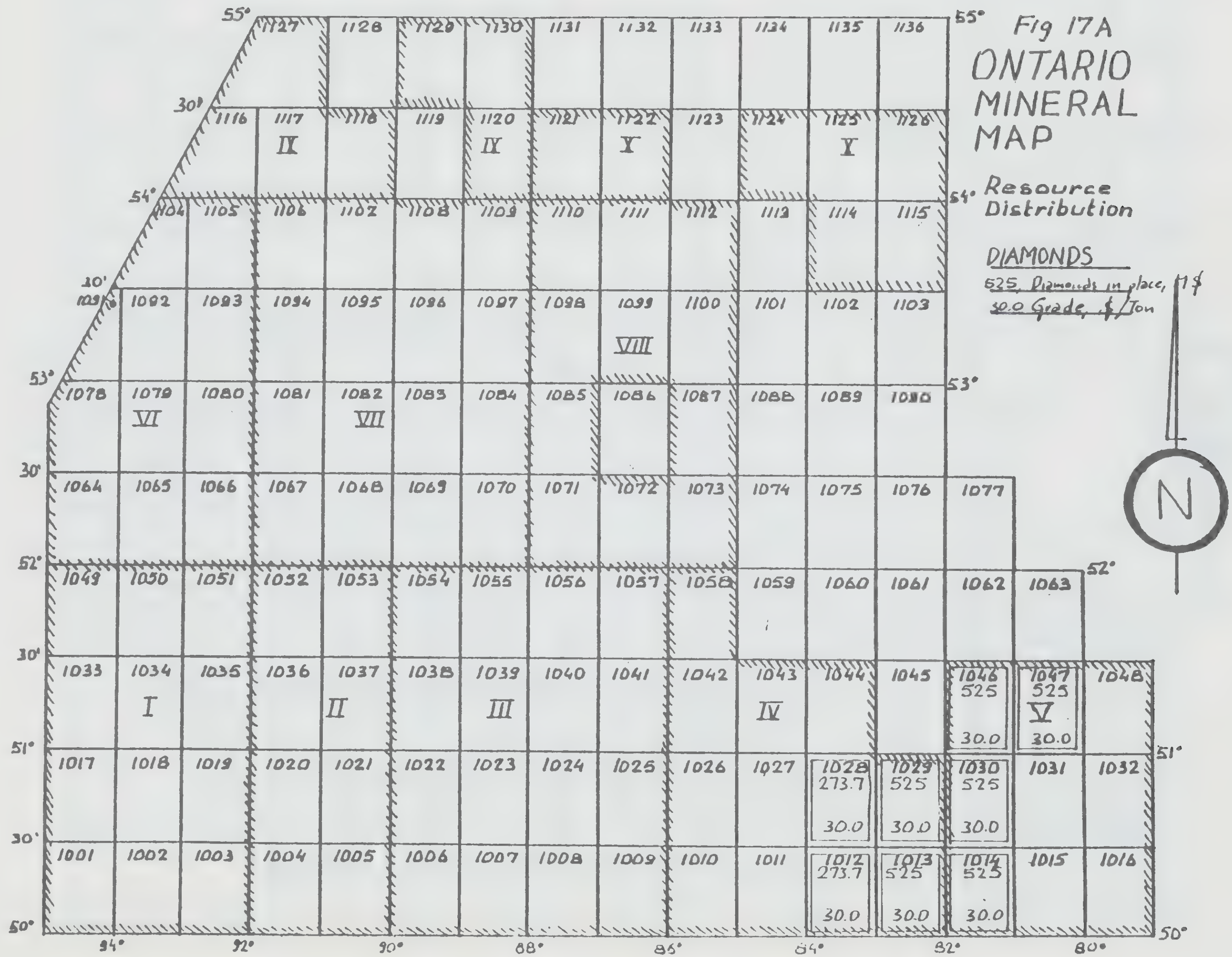


Fig 17A
ONTARIO
MINERAL
MAP
Resource
Distribution
DIAMONDS
525, Diamonds in place, M$
30.0 Grade, $/Ton
N
1046
525
30.0
1047
525
V
30.0
1028
273.7
30.0
1029
525
30.0
1030
525
30.0
1012
273.7
30.0
1013
525
30.0
1014
525
30.0

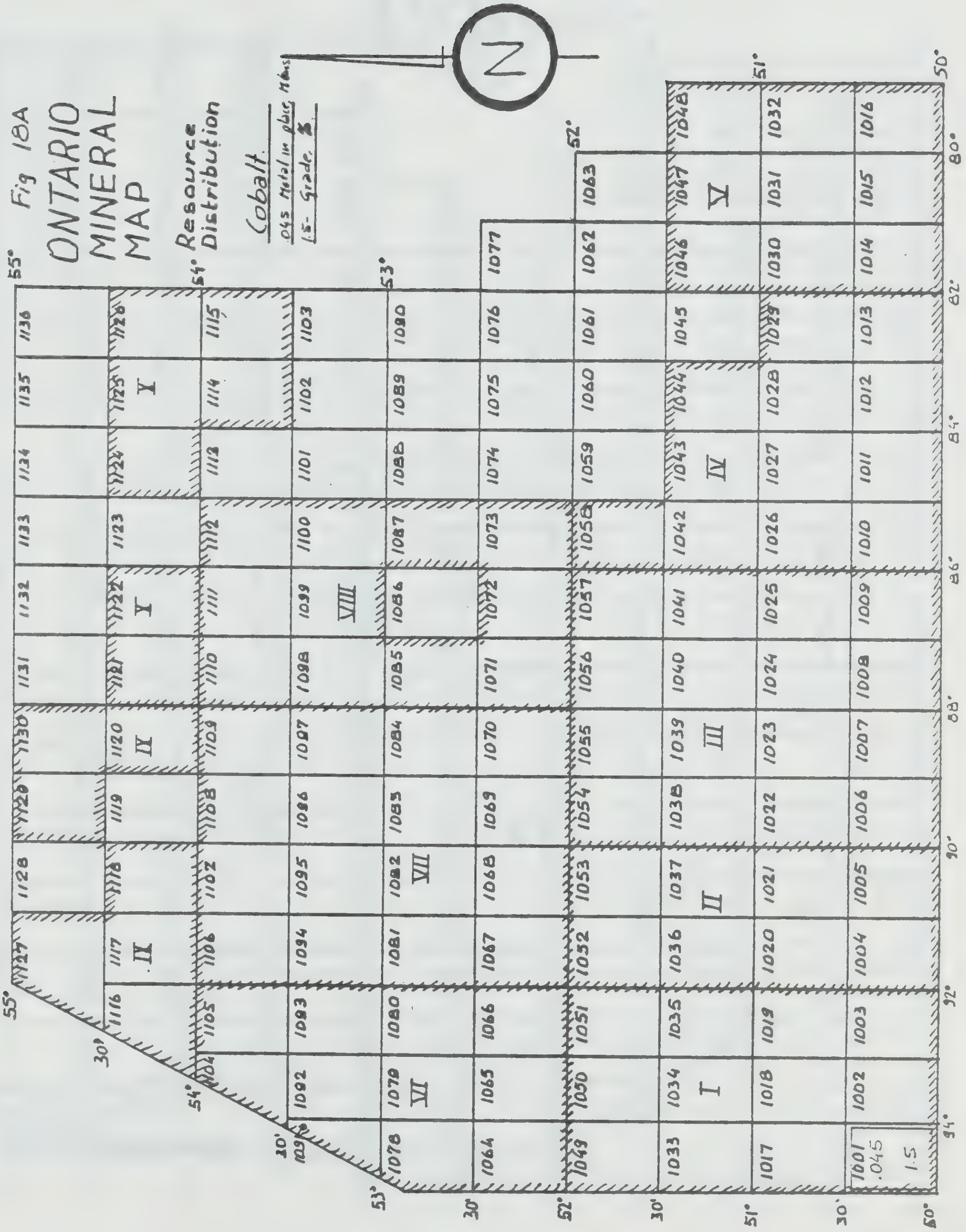


Fig 18A
ONTARIO
MINERAL
MAP
Resource
Distribution
Cobalt
N

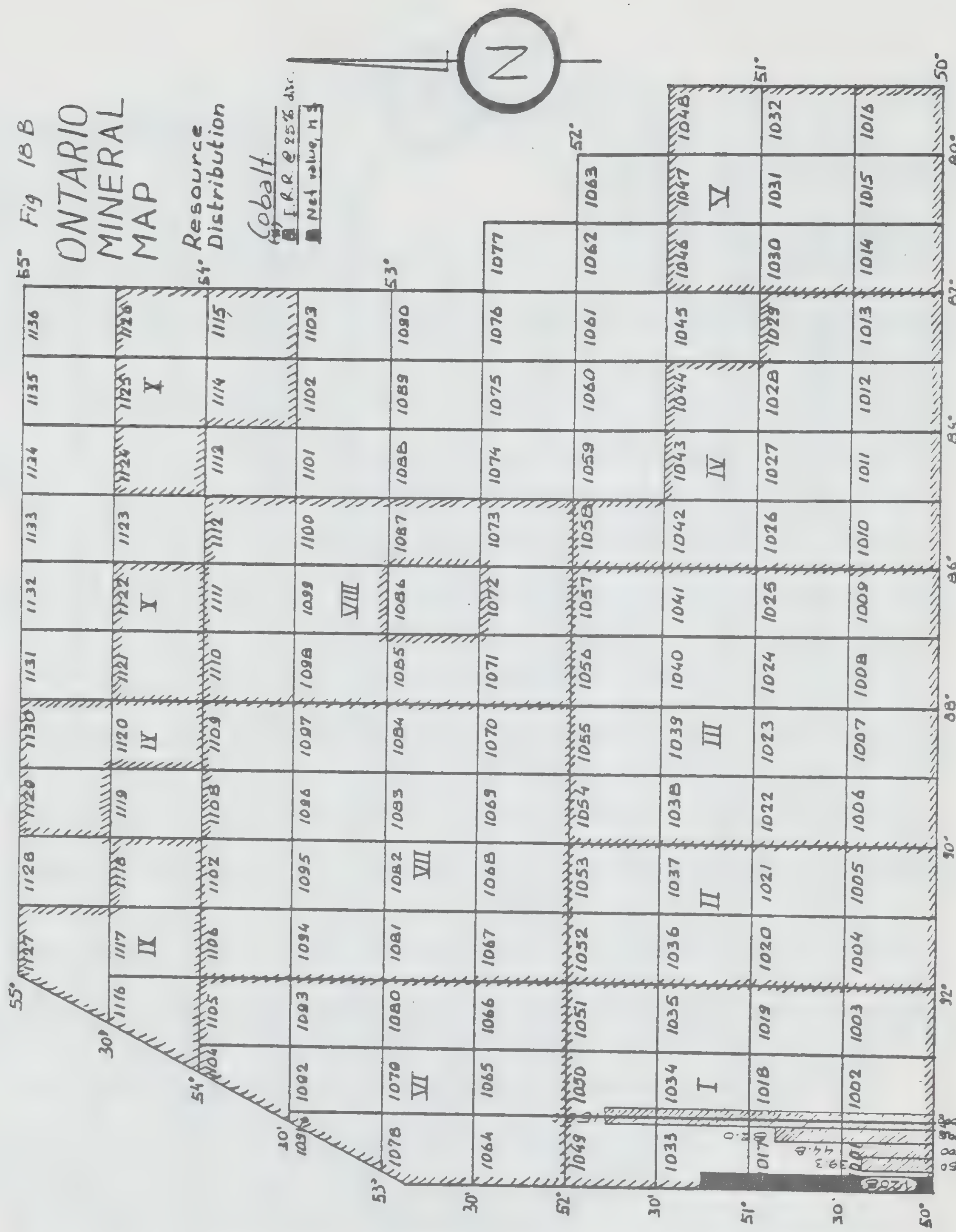


Fig 18 B
ONTARIO
MINERAL
MAP
Resource
Distribution
Cobalt
N

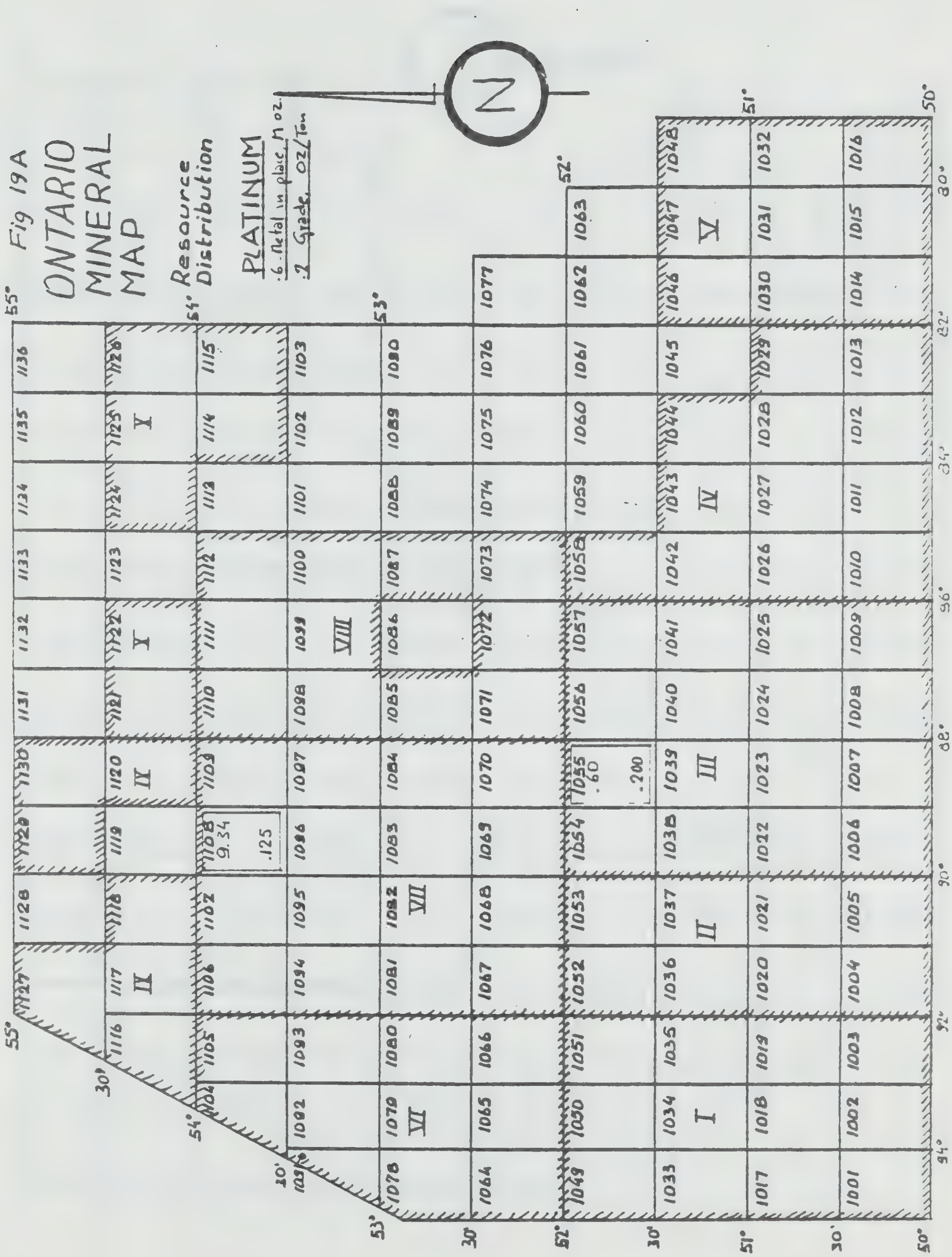


Fig 19A
ONTARIO
MINERAL
MAP
Resource
Distribution
PLATINUM
.6 Metal in place, M oz.
.2 Grade, OZ/Ton
N
1108
9.34
.125
1055
.60
.200

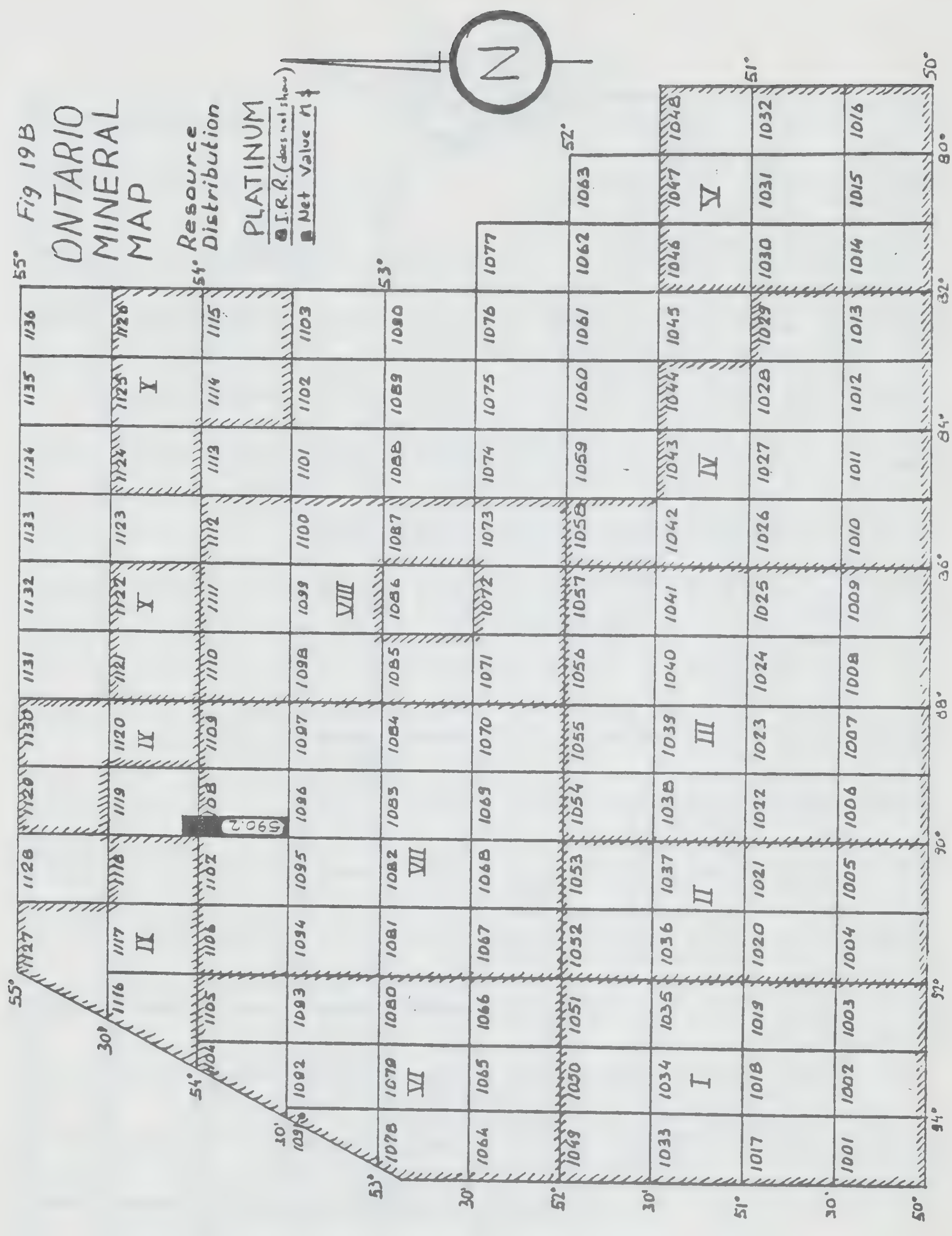


Fig 19B
ONTARIO
MINERAL
MAP
Resource
Distribution
PLATINUM
I.R.R. (does not show)
Net Value M $
590.2

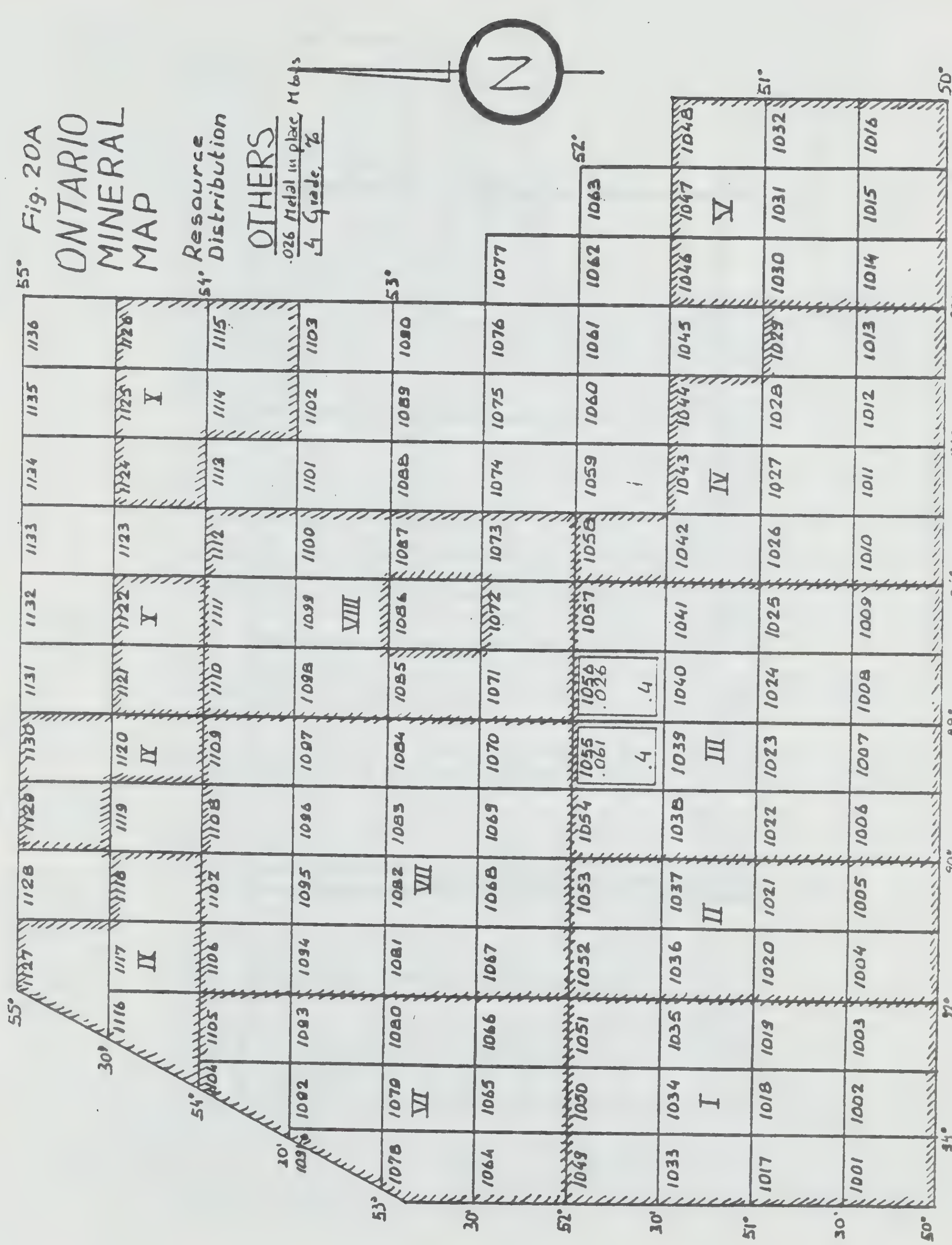


Fig. 20A
ONTARIO
MINERAL
MAP
Resource
Distribution
OTHERS
.026 Metal in place, M bls
.4 Grade, %
N

TABLE N° 1

BLOCK	N° of CELLS	AREA (SQ MILES)	
1	12	16928	
2	8	12696	
3	16	25392	
4	12	19044	
5	9	14283	
6	11	16398	
7	16	25392	
8	11	17457	
9	7	11902	
10	7	11109	

TABLE N°3A

MINERAL CONTENT OF STUDY AREA.

MINERAL	N° of Cells	N° of Dep.	TOTAL in M()	Avg Grade	Std. Dev.	Avg Grade /dep	Std. Dev.
Copper	21	24	.893 MT	2.404 %	.0092	2.208 %	.0069
Cu. Zn.	31	41.75	7.329 MT	3.821 %	.0093	3.895 %	.0088
Base Metals	87	101.97	33.43 MT	8.226 %	.0224	8.371 %	.0246
Pb. Zn	24	38	33.26 MT	8.671 %	.0423	8.368 %	.0430
Ni Cu	23	23.73	4.001 MT	1.555 %	.0013	1.583 %	.0008
Molybdenum	5	7	.097 MT	.449 %	.0013	.457 %	.0014
Uranium	19	23.67	599.5 MIb	2.155 lb/T	.759	2.311 lb/T	.7307
Gold	73	86.93	36.67 Moz	.2192 oz/T	.0278	.2137 oz/T	.0250
Silver	24	47.03	849.8 Moz	2.219 oz/T	0.712	2.874 oz/T	1.434
Iron	16	33.75	1223 MT	27.35 %	.0314	26.91 %	.0325
Li Cb	24	25.5	2.508 MT	1.623 %	.0033	1.618 %	.0032
Coal	6	6	155.7 MT	34.19 %	.0605	28.97 %	.0765
Chromium	2	3	4.87	17.5 %	.0003	18 %	.0004
Diamonds	8	8	3696 M$	30.0 $/T	.0000	30.0 $/T	.0000
Cobalt	1	1	.045 MT	1.50 %	.0000	1.50 %	.0000
Platinum	2	2	9.975 Moz	.1279 oz/T	.0144	.1625 oz/T	.0375
Others	2	2	.088 MT	.400 %	.0000	.400 %	.0000
Total		475.33					

Legend:

MT - million tons
Moz - million ounces
M$ - million dollars

Oz/T - ounces per ton
$/T - dollar per ton
lb/T - pounds per ton

BLOCK N° 1

Fig. 21

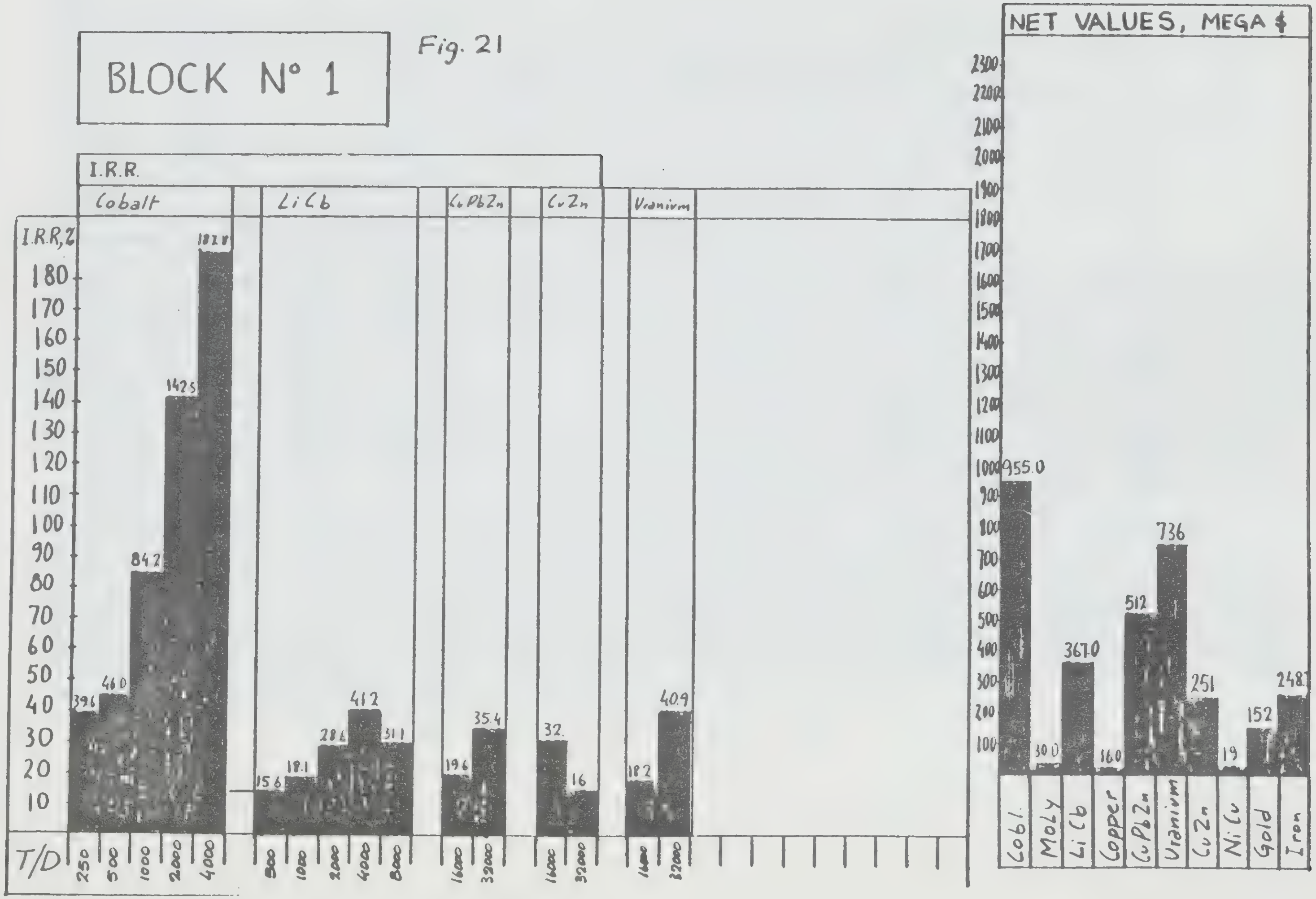


TABLE N° 3

BLOCK N° 1

MINERAL	N° of Dep	Metal in place	Value, Giga $	Avg grade	Std. Dev.	Ore per dep, MT	Std Dev.
Copper	5	.20 MT	.360	3.3 %	1.2 %	1.20	.900
Cu. Zn.	11.25	2.11 MT	2.347	4.1 %	.6 %	4.54	2.48
Base Metals	15.87	4.32 MT	4.147	7.8 %	1.7 %	3.47	2.40
Pb. Zn	—	—	—	—	—	—	—
Ni Cu	4.4	.14 MT	.574	1.6 %	—	1.93	.76
Molybdenum	1	.02 MT	.294	.8 %	—	3.00	—
Uranium	2	136.5 Mlb	5.811	1.75 lb/T	—	39.0	36.0
Gold	13.67	6.16 Moz	1.892	.216 oz/T	.016	2.08	1.04
Silver	12.33	60.5 Moz	.671	2.00 oz/T	—	2.45	.903
Iron	5	130.2 MT	8.501	27.3 %	1.0 %	95.5	66.8
Li Cb	7.5	.10 MT	1.075	1.5 %	—	.87	.25
Coal	—	—	—	—	—	—	—
Chromium	1	.34 MT	1.33	17.5%	—	3.0	—
Diamonds	—	—	—	—	—	—	—
Cobalt	1	.04 MT	2.212	1.5 %	—	3.0	—
Platinum	—	—	—	—	—	—	—
TOTAL	78.0			—	—	750.42	—

Legend:

MT – million tons
Moz – million ounces
M$ – million dollars

Oz/T – ounces per ton
$/T – dollar per ton
lb/T – pounds per ton

PLACE VALUES

MINERAL	N° of Dep	Metal in place	Value, Giga $	Avg grade	Std Dev.	Ore per dep, MT	Std Dev.
Copper	4.0	.11 MT	.194	2 %	—	1.31	.97
Cu. Zn.	7	1.52 MT	1.694	3.5 %	1 %	6.25	3.00
Base Metals	10.49	3.68 MT	3.534	8 %	1.9 %	4.41	1.39
Pb. Zn	1.	1.05 MT	.944	6 %	—	17.5	—
Ni Cu	4.4	1.04 MT	4.423	14 %	.2 %	10.35	10.15
Molybdenum	3	.01 MT	.110	.4 %	—	.75	—
Uranium	1	76.56 M	3.259	4.37 lb/T	—	17.5	—
Gold	11.22	3.50 Moz	1.075	.212 oz/T	.016	1.47	.55
Silver	11.5	640.87 M	7.107	2.04 oz/T	.205	27.33	56.28
Iron	12.92	507.09 M	33.11	26.7 %	2.6 %	146.8	7.28
Li Cb	2	.06 MT	.615	1.5 %	—	1.88	1.12
Coal	—	—	—	—	—	—	—
Chromium	—	—	—	—	—	—	—
Diamonds	—	—	—	—	—	—	—
Cobalt	—	—	—	—	—	—	—
Platinum	—	—	—	—	—	—	—
Total	71.13	1235.49	56.07	—	—	2436.20	—

TABLE N° 4
BLOCK N° 2

Legend:

MT – million tons
Moz – million ounces
M$ – million dollars

Oz/T – ounces per ton
$/T – dollar per ton
lb/T – pounds per ton

PLACE VALUES

BLOCK N° 2

Fig. 22

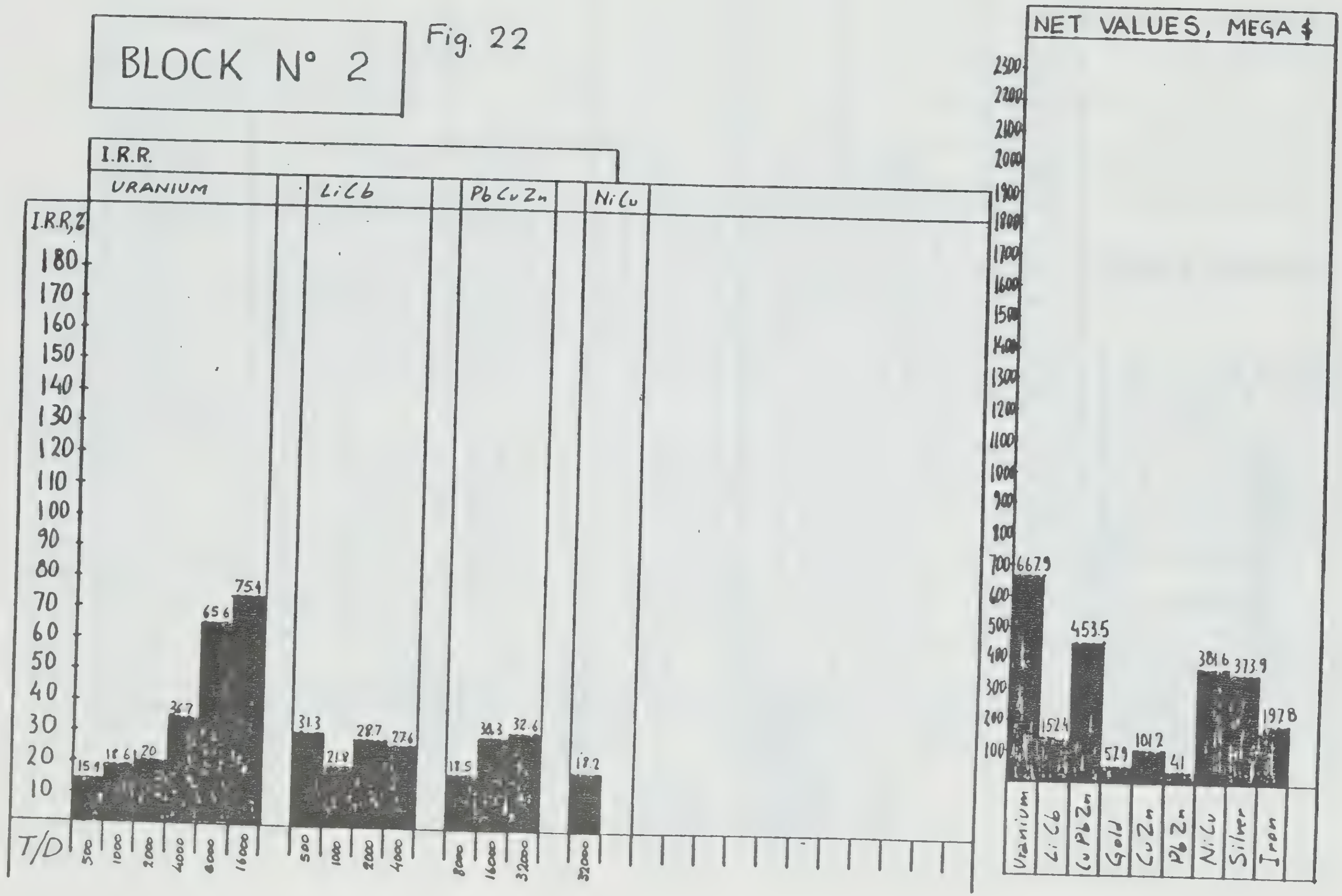


TABLE N°5

BLOCK N° 3

MINERAL	N° of Dep	Metal in place	Value, Giga $	Avg grade	Std Dev.	Ore per dep, MT	Std Dev.
Copper	4	.17 MT	.318	2 %	—	2.16	.93
Cu. Zn.	11.5	1.74 MT	1.934	3.3 %	1.1 %	4.53	2.39
Base Metals	16.11	7.21 MT	6.924	8.3 %	1.1 %	5.41	2.34
Pb. Zn	6	10.52 MT	9.464	11.9 %	.8 %	14.7	6.24
Ni Cu	5	.84 MT	3.575	1.6 %	—	10.55	10.87
Molybdenum	—	—	—	—	—	—	—
Uranium	2	52.01 Mlb	2.214	3.92 lb/T	—	6.64	3.83
Gold	19.23	6.88 Moz	2.112	.234 oz/T	.031	1.53	.76
Silver	12.5	48.4 Moz	.536	3.23 oz/T	1.697	1.20	.90
Iron	8.5	268.6 MT	17.539	27.0 %	3.1 %	116.91	41.78
Li Cb	3	.10	1.087	1.8 %	.4 %	1.88	1.59
Coal	—	—	—	—	—	—	—
Chromium	—	—	—	—	—	—	—
Diamonds	—	—	—	—	—	—	—
Cobalt	—	—	—	—	—	—	—
Platinum	1	.60 Moz	.211	.2 oz/T	—	3.00	—
Total	90,85	397.14	46.02	—	—	1374.02	—

Legend:

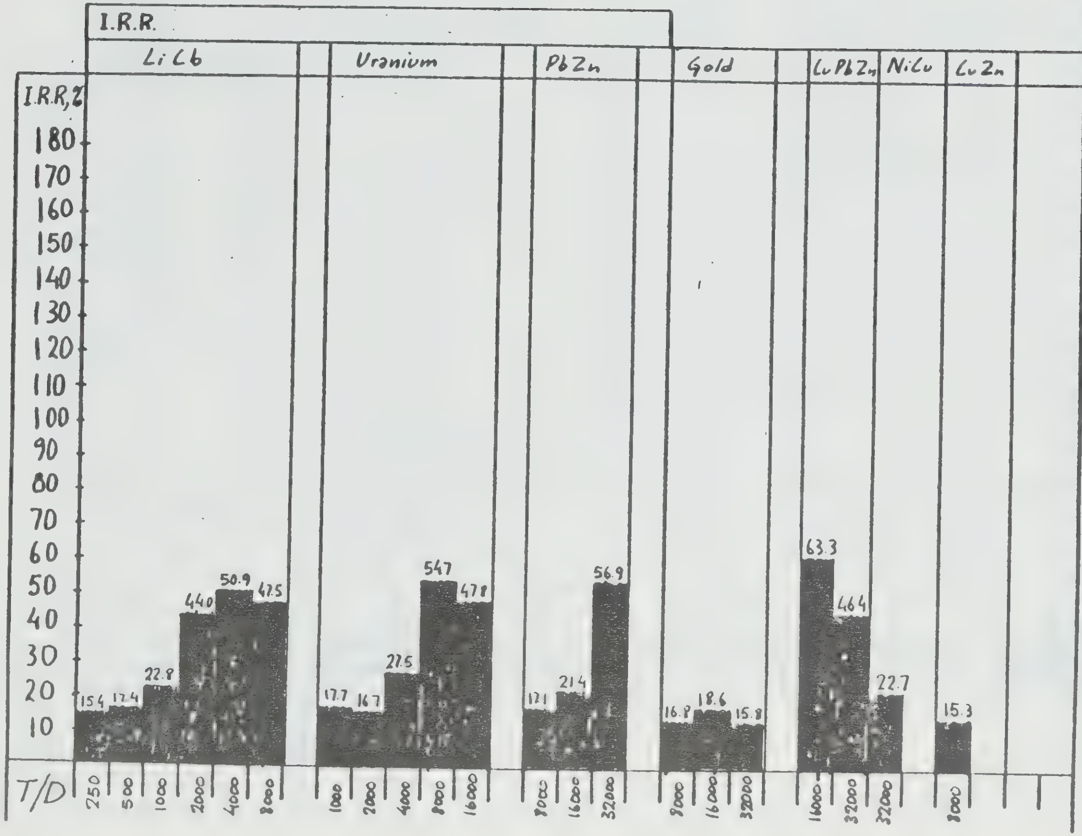
MT – million tons
Moz – million ounces
M$ – million dollars

Oz/T – ounces per ton
$/T – dollar per ton
lb/T – pounds per ton

PLACE VALUES

BLOCK N° 3

Fig 23



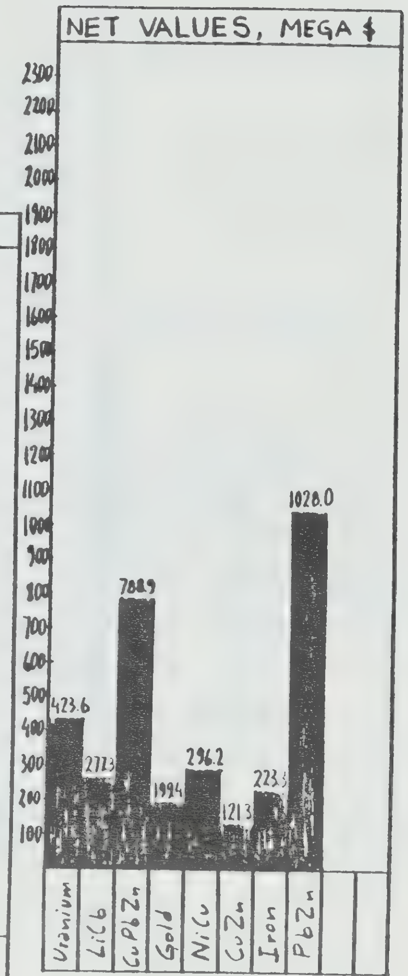


TABLE N°6

BLOCK N°4

MINERAL	N° of Dep	Metal in place	Value, Giga $	Avg grade	Std Dev.	Ore per dep, MT	Std. Dev.
Copper	—	—	—	—	—	—	—
Cu. Zn.	2	.67 MT	.751	4.5 %	—	7.5	—
Base Metals	8	2.29 MT	2.195	9.7 %	2.7 %	2.94	1.82
Pb. Zn	15	16.42 MT	14.772	12 %	—	9.12	3.74
Ni Cu	—	—	—	—	—	—	—
Molybdenum	—	—	—	—	—	—	—
Uranium	—	—	—	—	—	—	—
Gold	—	—	—	—	—	—	—
Silver	—	—	—	—	—	—	—
Iron	—	—	—	—	—	—	—
Li Cb	—	—	—	—	—	—	—
Coal	2	75 MT	3.000	40 %	5 %	93.75	56.3
Chromium	—	—	—	—	—	—	—
Diamonds	4	1598 M$	1.598 M$	30.0 $/T	—	13.31	4.19
Cobalt	—	—	—	—	—	—	—
Platinum	—	—	—	—	—	—	—
Total	31.	1691.84	22.32	—	—	416.17	—

Legend:

MT – million tons
Moz – million ounces
M$ – million dollars

Oz/T – ounces per ton
$/T – dollar per ton
lb/T – pounds per ton

PLACE VALUES

Fig. 24

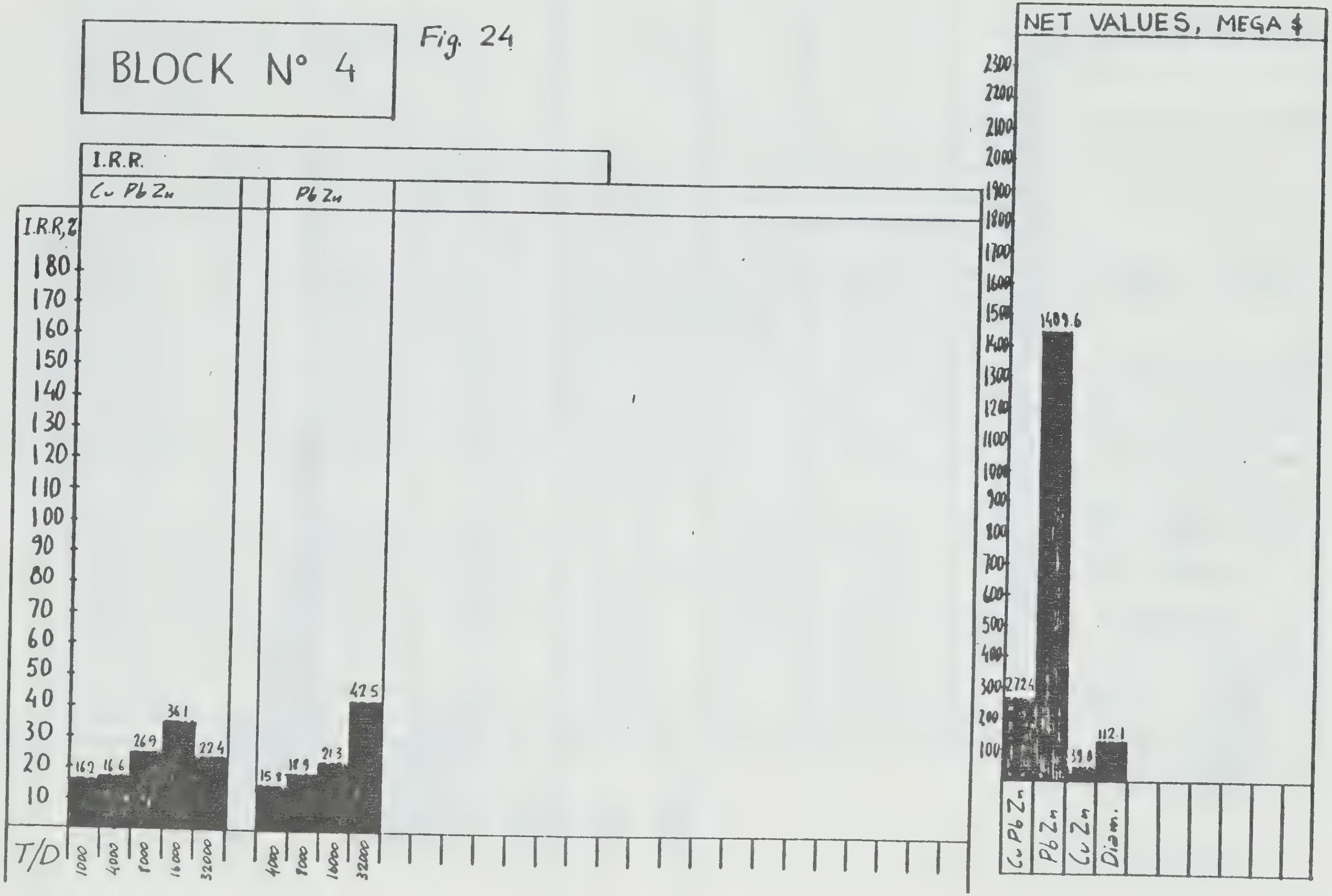

BLOCK N° 4
I.R.R.
Cu Pb Zn
Pb Zn
I.R.R,%
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
T/D
1000
4000
8000
16000
32000
4000
8000
16000
32000
16.2
16.6
26.9
36.1
22.4
15.8
18.9
21.3
42.5
NET VALUES, MEGA $
2300
2200
2100
2000
1900
1800
1700
1600
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
272.4
1409.6
39.8
112.1
Cu Pb Zn
Pb Zn
Cu Zn
Diam.

TABLE N°7

BLOCK N°5

MINERAL	N° of Dep	Metal in place	Value, Giga $	Avg grade	Std. Dev.	Ore per dep, MT	Std. Dev.
Copper	2	.12 MT	.222	2 %	—	3.00	—
Cu. Zn.	4	.48 MT	.534	4 %	.5 %	3.00	—
Base Metals	10.5	3.11 MT	2.984	10.4 %	1.9 %	2.84	1.98
Pb. Zn	3	2.38 MT	2.145	5 %	3.7 %	16.00	15.31
Ni Cu	—	—	—	—	—	—	—
Molybdenum	2	.01 MT	.074	.4 %	—	.75	—
Uranium	2	26.25 Mlb	1.117	1.75 lb/T	—	7.5	—
Gold	4	7.90 Moz	2.426	.222 oz/T	.041	8.91	5.73
Silver	3	36.8 Moz	.408	4.08 oz/T	.932	3.00	3.18
Iron	—	—	—	—	—	—	—
Li Cb	2	1.00 MT	10.94	1.8 %	.5 %	27.5	10.0
Coal	4	80.8 MT	3.231	30.1 %	2.1 %	67.03	63.6
Chromium	—	—	—	—	—	—	—
Diamonds	4	2100 M$	2.100	300 $/T	—	17.5	—
Cobalt	—	—	—	—	—	—	—
Platinum	—	—	—	—	—	—	—
Total	40.5	2258.78	26.18	—	—	550.05	—

Legend:

MT – million tons
Moz – million ounces
M$ – million dollars

Oz/T – ounces per ton
$/T – dollar per ton
lb/T – pounds per ton

PLACE VALUES

BLOCK N° 5

Fig. 25

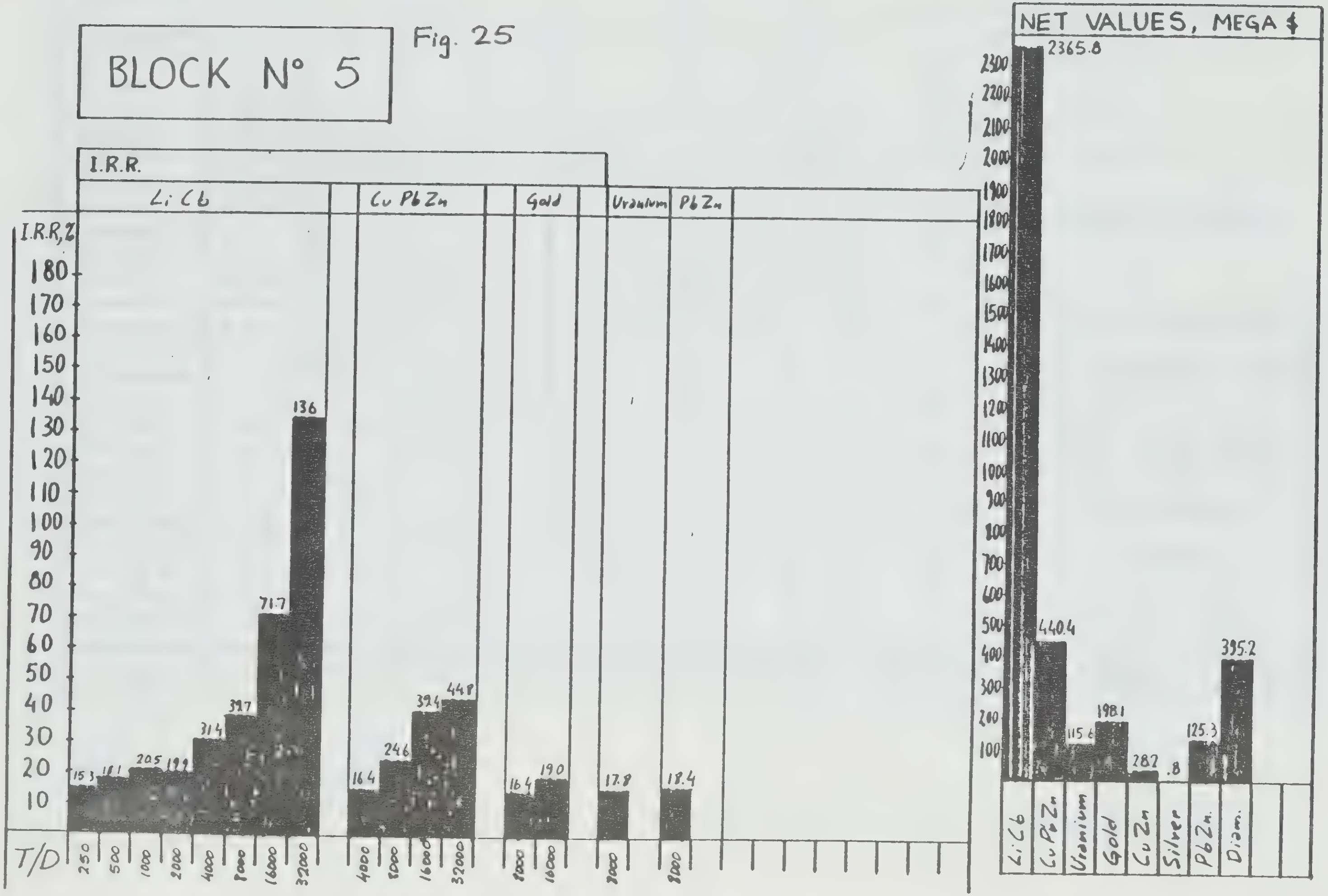


TABLE N°8

BLOCK N°6

MINERAL	N°of Dep	Metal in place	Value, Giga $	Avg grade	Std. Dev.	Ore per dep, MT	Std Dev.
Copper	4	.11 MT	.194	2 %	—	1.31	.97
Cu. Zn.	5	.67 MT	.751	4.5 %	—	3.0	—
Base Metals	11.5	2.61 MT	2.502	6.3 %	.7 %	3.62	1.89
Pb. Zn	!	.18 MT	.162	6 %	—	3.0	—
Ni Cu	1	.28 MT	1.186	1.6 %	—	17.5	—
Molybdenum	1	.07 MT	.858	.4 %	—	17.5	—
Uranium	3.67	31.3 Mlb	1.333	2.12 lb/T	.206	4.02	1.12
Gold	10.96	3.55 Moz	1.091	.222 oz/T	.013	1.46	.48
Silver	4.7	24.7 Moz	.274	4.51 oz/T	.281	1.17	.96
Iron	7.33	317.6 MT	20.74	28.7 %	4 %	150.8	1.14
Li Cb	2	.02 MT	.246	1.5 %	—	.75	—
Coal	—	—	—	—	—	—	—
Chromium	—	—	—	—	—	—	—
Diamonds	—	—	—	—	—	—	—
Cobalt	—	—	—	—	—	—	—
Platinum	—	—	—	—	—	—	—
Total	56.16	381.09	29.34	—	—	1243.29	—

Legend:

MT – million tons
Moz – million ounces
M$ – million dollars

Oz/t – ounces per ton
$/T – dollar per ton
lb/t – pounds per ton

PLACE VALUES

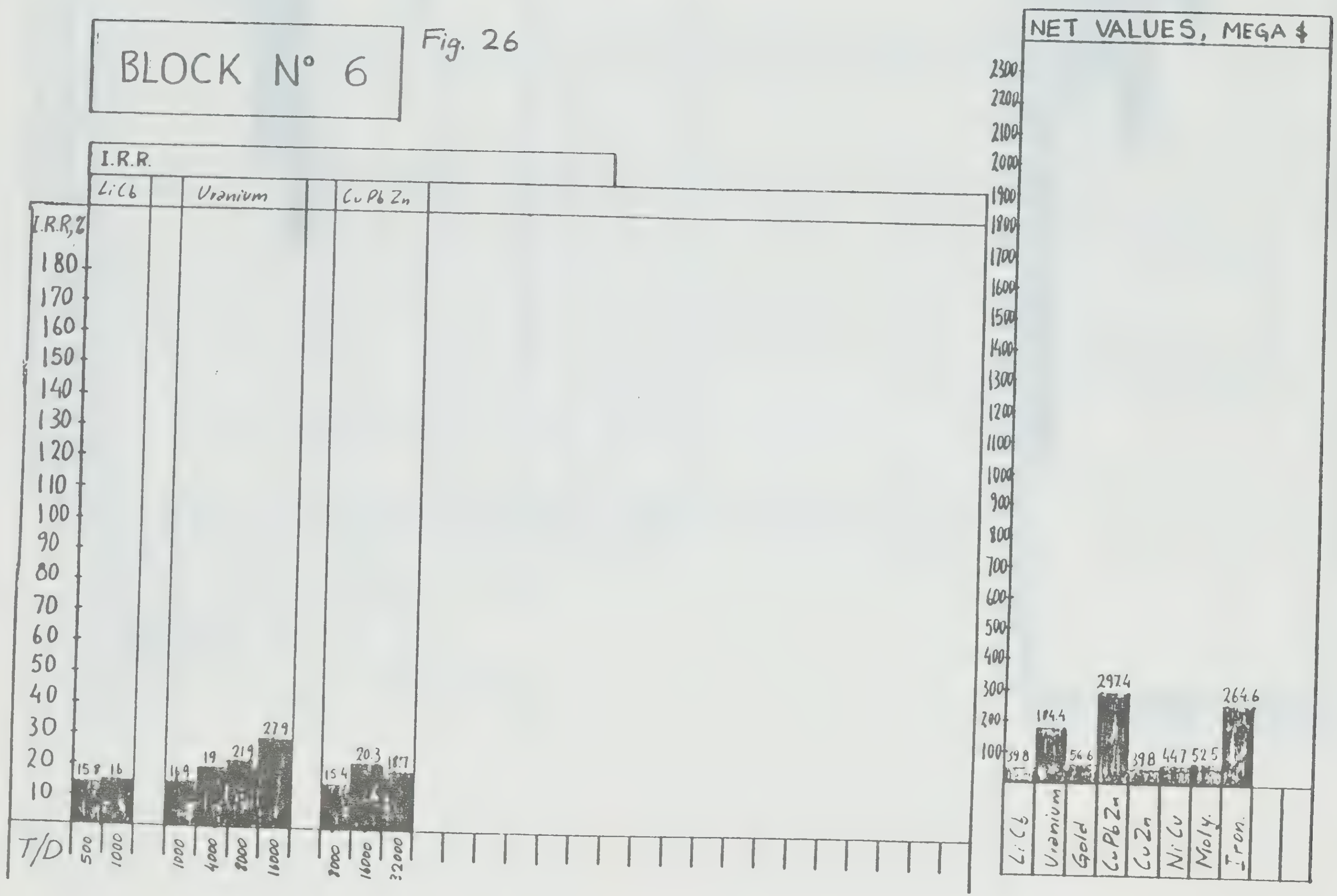

BLOCK N° 6
I.R.R.
Li Cb
Uranium
Cu Pb Zn
I.R.R,%
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
15.8
16
16.9
19
21.9
27.9
15.4
20.3
18.7
T/D
500
1000
1000
4000
8000
16000
8000
16000
32000
NET VALUES, MEGA $
2300
2200
2100
2000
1900
1800
1700
1600
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
39.8
184.4
56.6
297.4
39.8
44.7
52.5
264.6
Li Cb
Uranium
Gold
Cu Pb Zn
Cu Zn
Ni Cu
Moly.
Iron.

Fig. 26

Fig. 27

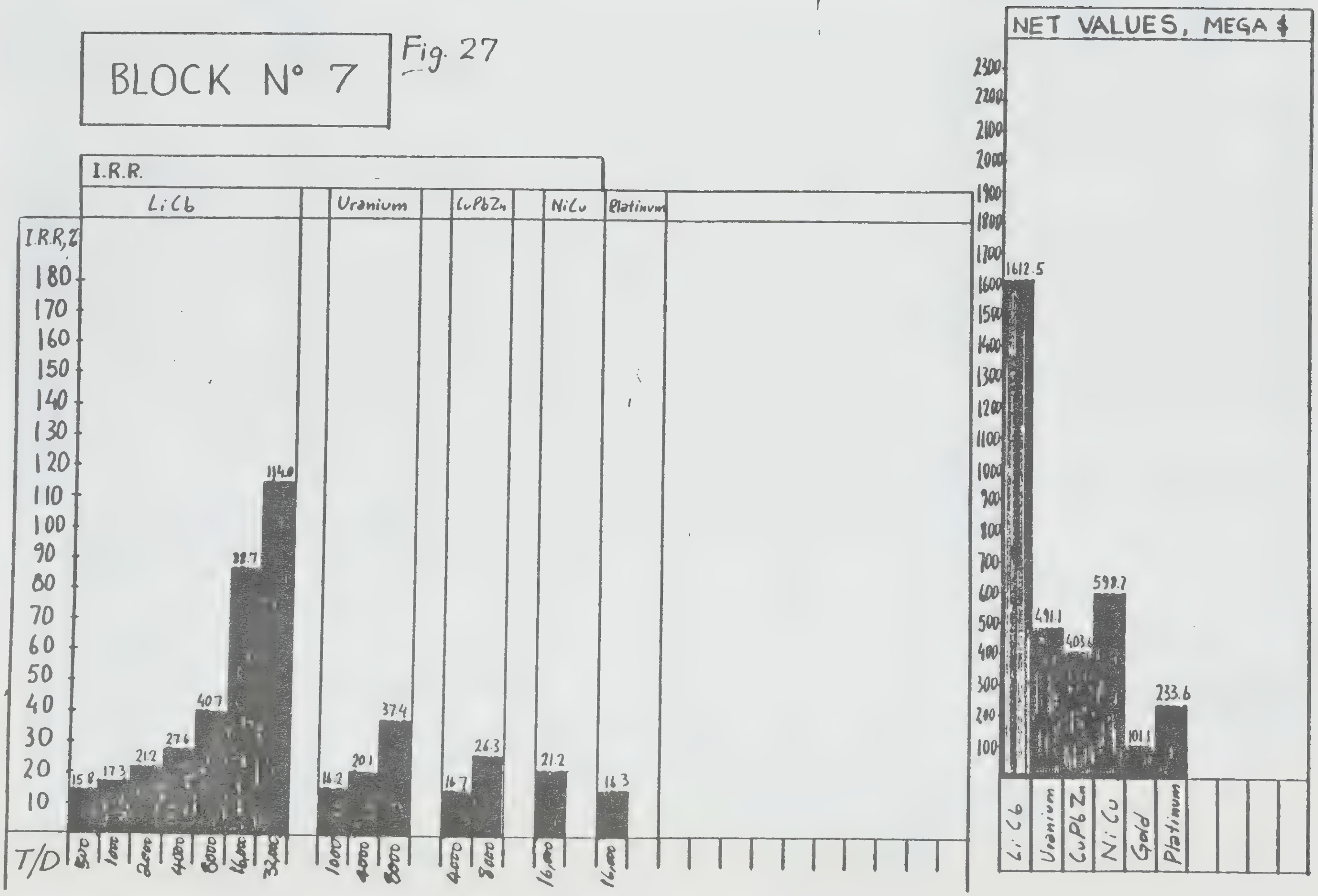

BLOCK N° 7
I.R.R.
I.R.R,%
LiCb
Uranium
CuPbZn
NiCu
Platinum
T/D
500
1000
2000
4000
8000
16,000
32,000
15.8
17.3
21.2
27.6
40.7
88.7
114.0
16.2
20.1
37.4
16.7
26.3
21.2
16.3
NET VALUES, MEGA $
Li Cb
Uranium
CuPbZn
Ni Cu
Gold
Platinum
1612.5
491.1
403.6
598.7
101.1
233.6

TABLE N° 10

BLOCK N° 8

MINERAL	N° of Dep	Metal in place	Value, Giga $	Avg grade	Std Dev.	Ore per dep, MT	Std Dev.
Copper	—	—	—	—	—	—	—
Cu. Zn.	—	—	—	—	—	—	—
Base Metals	8	2.07 MT	1.988	9.5 %	3. %	2.72	.74
Pb. Zn	—	—	—	—	—	—	—
Ni Cu	—	—	—	—	—	—	—
Molybdenum	—	—	—	—	—	—	—
Uranium	—	—	—	—	—	—	—
Gold	6	1.58 Moz	.484	.20 oz/T	—	131	.86
Silver	—	—	—	—	—	—	—
Iron	—	—	—	—	—	—	—
Li Cb	—	—	—	—	—	—	—
Coal	—	—	—	—	—	—	—
Chromium	—	—	—	—	—	—	—
Diamonds	—	—	—	—	—	—	—
Cobalt	—	—	—	—	—	—	—
Platinum	—	—	—	—	—	—	—
Total	14	3.65	2.47	—	—	29.63	—

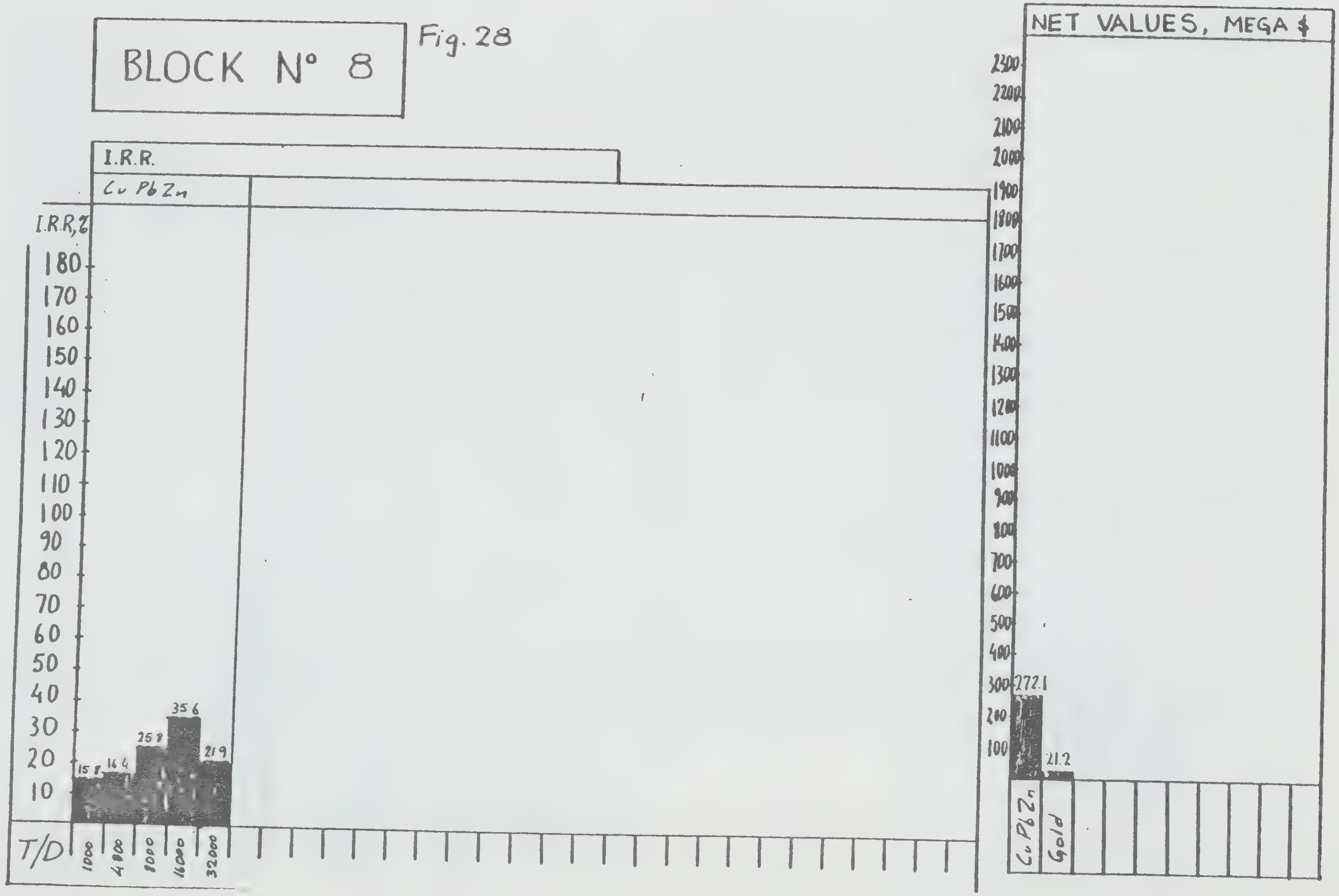
Legend:

MT – million tons
Moz – million ounces
M$ – million dollars

Oz/T – ounces per ton
$/T – dollar per ton
lb/T – pounds per ton

PLACE VALUES

Fig. 28


BLOCK N° 8
I.R.R.
Cu Pb Zn
I.R.R,%
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
15.8
16.4
25.8
35.6
21.9
T/D
1000
4000
8000
16000
32000
NET VALUES, MEGA $
2300
2200
2100
2000
1900
1800
1700
1600
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
272.1
21.2
Cu Pb Zn
Gold

MINERAL	N° of Dep	Metal in place	Value, Giga $	Avg grade	Std Dev.	Ore per dep, MT	Std. Dev.
Copper	1	.02 MT	.028	2 %	—	.75	—
Cu. Zn.	—	—	—	—	—	—	—
Base Metals	7.5	3.84 MT	3.687	10.8 %	1.7 %	4.75	1.68
Pb. Zn	—	—	—	—	—	—	—
Ni Cu	—	—	—	—	—	—	—
Molybdenum	—	—	—	—	—	—	—
Uranium	2	61.25 Mlb	2.607	1.75 lb/T	—	17.5	—
Gold	4.29	1.83 Moz	.561	.210 oz/T	.011	2.03	.59
Silver	1	33.75 Moz	.374	4.5 oz/T	—	7.5	—
Iron	—	—	—	—	—	—	—
Li Cb	2	.52 MT	5.743	1.5 %	—	17.5	-
Coal	—	—	—	—	—	—	—
Chromium	—	—	—	—	—	—	—
Diamonds	—	—	—	—	—	—	—
Cobalt	—	—	—	—	—	—	—
Platinum	—	—	—	—	—	—	—
Total	17.79	101.21	13.00	-	-	122.57	-

TABLE N° 11

BLOCK N° 9

Legend:

MT – million tons
Moz – million ounces
M$ – million dollars

Oz/T – ounces per ton
$/T – dollar per ton
lb/T – pounds per ton

PLACE VALUES

BLOCK N° 9

Fig. 29

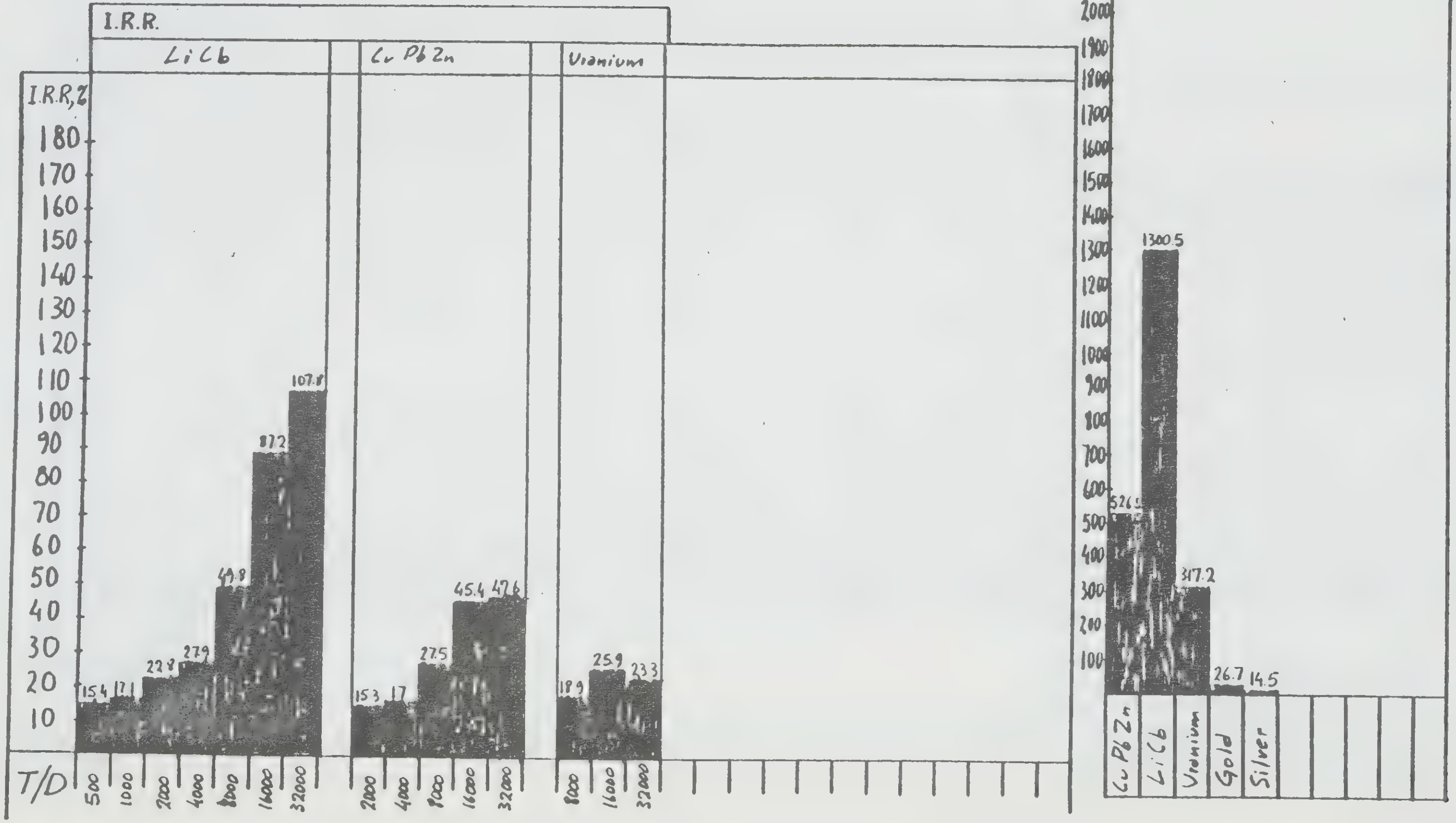


TABLE N°12

BLOCK N° 10

MINERAL	N°of Dep	Metal in place	Value, Giga $	Avg grade	Std. Dev.	Ore per dep, MT	Std Dev.
Copper	1	.13 MT	.249	4.5 %	—	3.0	—
Cu. Zn.	—	—	—	—	—	—	—
Base Metals	2	.72 MT	.691	12 %	—	3.0	—
Pb. Zn	12	2.7 MT	2.428	3 %	—	7.5	—
Ni Cu	—	—	—	—	—	—	—
Molybdenum	—	—	—	—	—	—	—
Uranium	8	123.8 Mlb	5.268	2.38 lb/T	—	6.51	—
Gold	1	.41 Moz	.127	.250 oz/T	—	1.65	—
Silver	—	—	—	—	—	—	—
Iron	—	—	—	—	—	—	—
Li Cb	—	—	—	—	—	—	—
Coal	—	—	—	—	—	—	—
Chromium	—	—	—	—	—	—	—
Diamonds	—	—	—	—	—	—	—
Cobalt	—	—	—	—	—	—	—
Platinum	—	—	—	—	—	—	—
Total	24	127.71	8.76	—	—	152.75	—

Legend:

MT – million tons
Moz – million ounces
M$ – million dollars

Oz/T – ounces per ton
$/T – dollar per ton
lb/T – pounds per ton

PLACE VALUES

Fig. 30

BLOCK N° 10

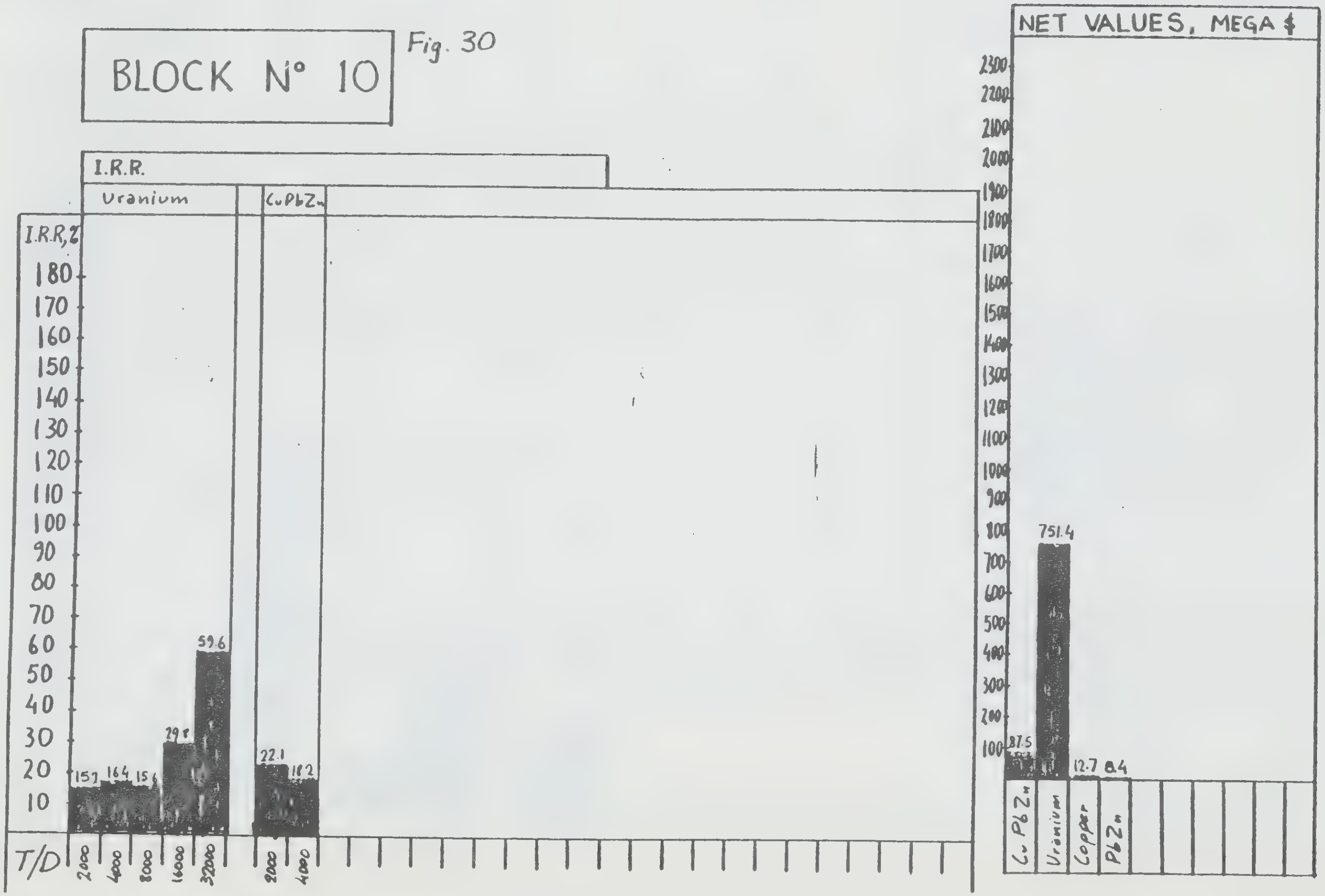


Fig 31

INTERNAL RATE OF RETURN VS. REVENUE-OPERATING COST RATIO
Exploration and development cost=0

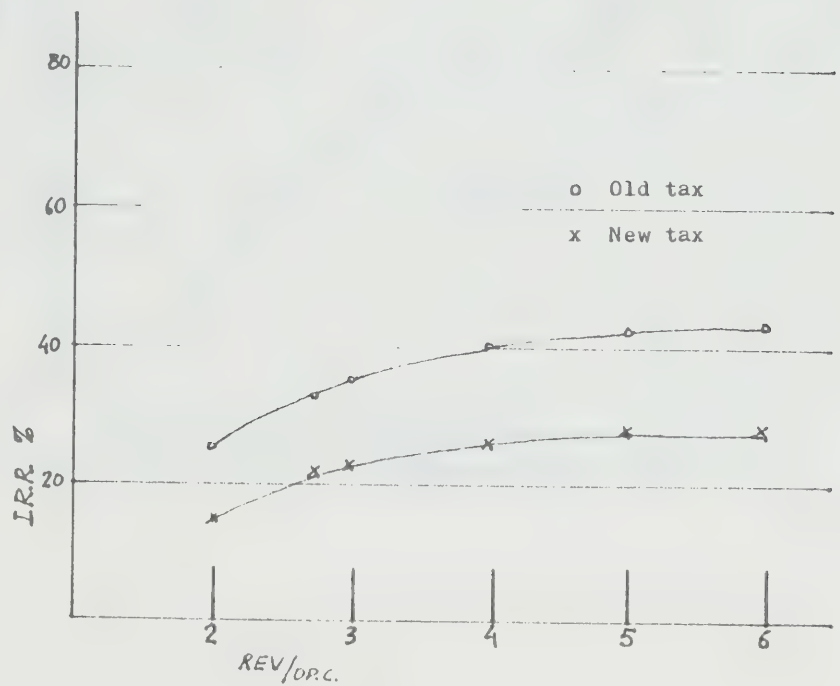


Fig. 32

PAYBACK PERIOD VS. REVENUE-OPERATING COST RATIO
Exploration and development cost= 0, DCF rate=25%

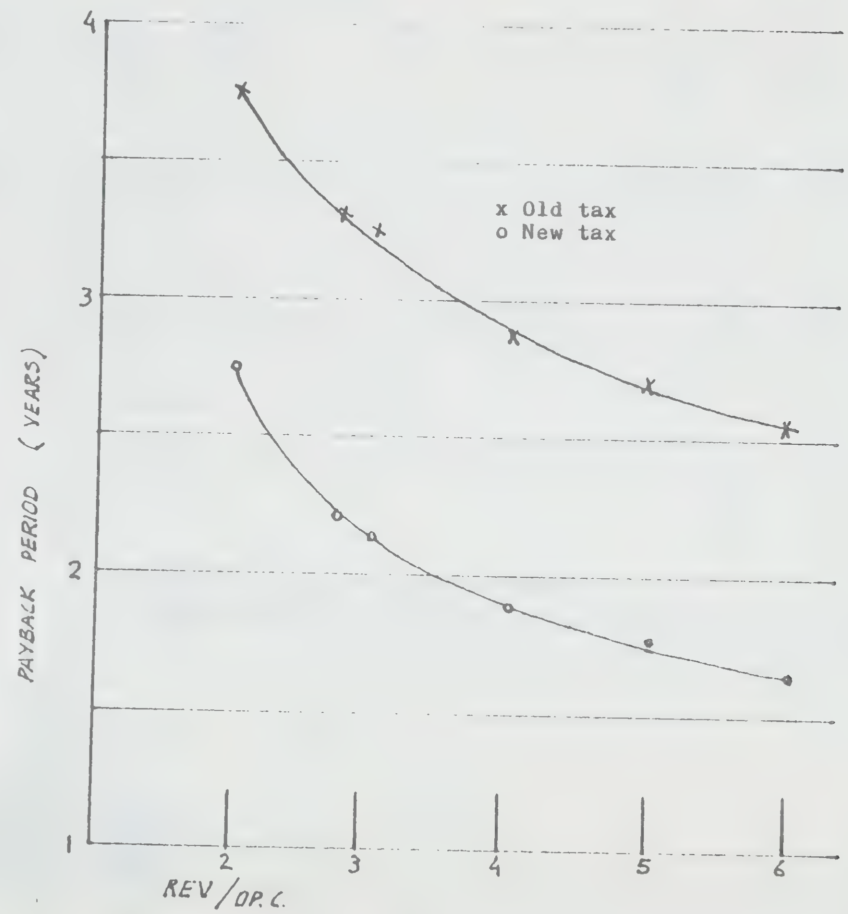


Fig 33

INTERNAL RATE OF RETURN VS. OPERATING COST RATIO

Exploration and development cost= 0.375 of revenue

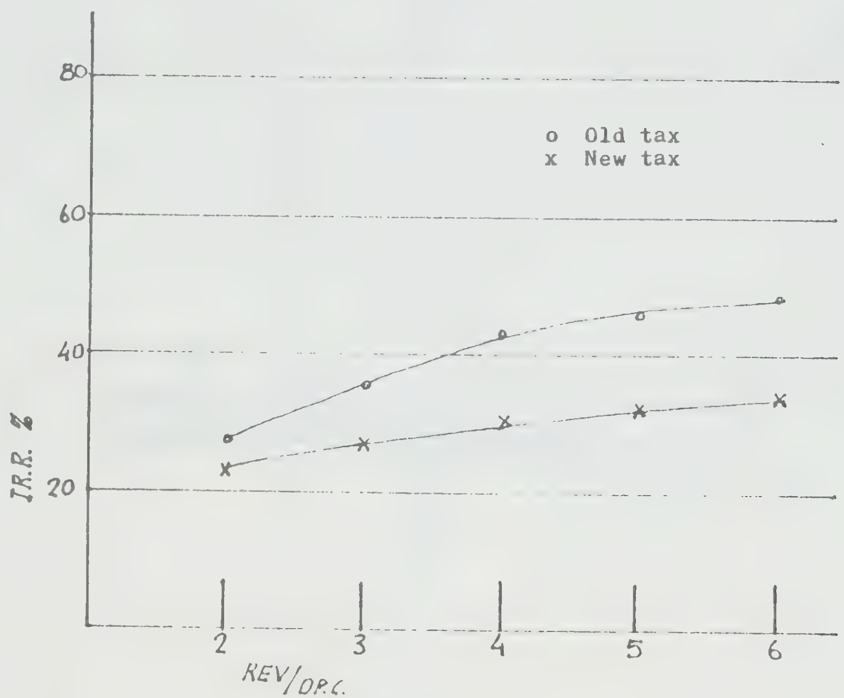


Fig 34

PAYBACK PERIOD VS. REVENUE/OPERATING COST RATIO
Exploration and development cost= 0.375 of revenue

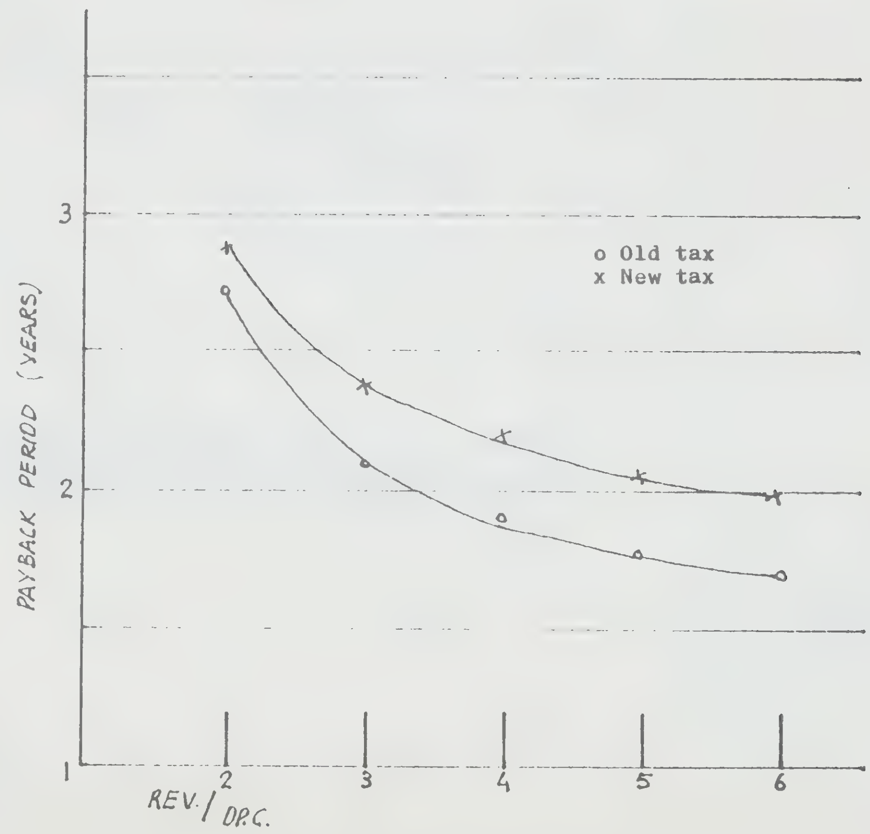
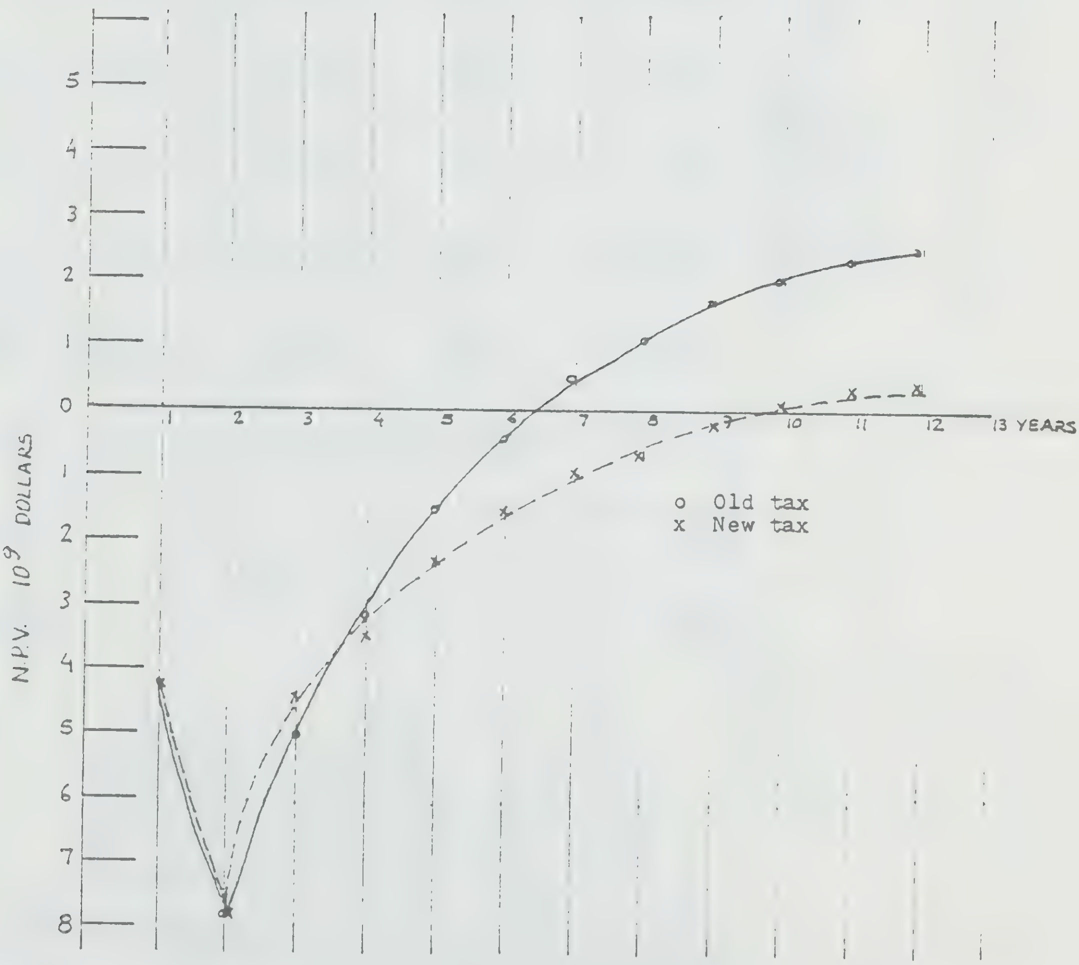


Fig 35

NPV VS. YEARS
DCF rate =25% and REV./OPC.=2.67



CELL: 1001 METAL: COBL METHOD: OPEN PIT

(TONS/DAY: 1000.)

CASH FLOW AND EXPECTED PROFITABILITY CALCULATION
(THOUSANDS OF DOLLARS)

	1	2	3	4	5	6	7	8	9	10	TOTAL
REVENUE	127420.	127420.	127420.	127420.	127420.	127420.	127420.	127420.	127420.	127420.	1274200.
OPERATING COST	22820.	22820.	22820.	22820.	22820.	22820.	22820.	22820.	22820.	22820.	228200.
ROYALTIES	1270.	1270.	1270.	1270.	1270.	1270.	1270.	1270.	1270.	1270.	12700.
NET INC. FOR FED. TAX.	0.	0.	103330.	103330.	103330.	103330.	103330.	103330.	103330.	103330.	826640.
FED. CAP. COST ALLOW.	0.	0.	27620.	0.	0.	0.	0.	0.	0.	0.	27620.
FED. INC. FOR RESOURCE ALLOW.	0.	0.	75710.	103330.	103330.	103330.	103330.	103330.	103330.	103330.	799020.
FED. DEV. ALLOW.	0.	0.	450.	0.	0.	0.	0.	0.	0.	0.	450.
CANADIAN EXPL. EXPENSE	0.	0.	2540.	0.	0.	0.	0.	0.	0.	0.	2540.
FED. DEPLETABLE INC.	0.	0.	53793.	77498.	77498.	77498.	77498.	77498.	77498.	77498.	596275.
FED. EARNED DEPLETION	0.	0.	10203.	0.	0.	0.	0.	0.	0.	0.	10203.
FED. TAXABLE INC.	0.	0.	43589.	77498.	77498.	77498.	77498.	77498.	77498.	77498.	586072.
FED. TAX. AT 36%	0.	0.	15692.	27899.	27899.	27899.	27899.	27899.	27899.	27899.	210986.
NET INC. FOR ONT. TAX	0.	0.	103330.	103330.	103330.	103330.	103330.	103330.	103330.	103330.	826640.
ONT. CORP. CAP. COST ALLOW.	0.	0.	27620.	0.	0.	0.	0.	0.	0.	0.	27620.
ONT. CORP. DEV. EXP. ALLOW.	0.	0.	450.	0.	0.	0.	0.	0.	0.	0.	450.
ONT. CORP. EXPL. EXP. ALLOW.	0.	0.	2540.	0.	0.	0.	0.	0.	0.	0.	2540.
ONT. CORP. DEPLETABLE INC.	0.	0.	72720.	103330.	103330.	103330.	103330.	103330.	103330.	103330.	796030.
ONT. AUTOM. DEPL. ALLOW.	0.	0.	24240.	34443.	34443.	34443.	34443.	34443.	34443.	34443.	265343.
ONT. CORP. TAXABLE INC.	0.	0.	48480.	68887.	68887.	68887.	68887.	68887.	68887.	68887.	530687.
ONT. CORP. INC. TAX AT 13%	0.	0.	6302.	8955.	8955.	8955.	8955.	8955.	8955.	8955.	68989.
NET INC. FOR ONT MIN. TAX	0.	0.	104600.	104600.	104600.	104600.	104600.	104600.	104600.	104600.	836800.
ONT. MIN. CAP. COST ALLOW.	0.	0.	13810.	0.	0.	0.	0.	0.	0.	0.	13810.
ONT. MIN. PROC. CAP. ALLOW.	0.	0.	450.	0.	0.	0.	0.	0.	0.	0.	450.
ONT. MIN. DEV. EXP. ALLOW.	0.	0.	2072.	2072.	2072.	2072.	2072.	2072.	1381.	0.	13810.
ONT. MIN. EXPL. EXP. ALLOW.	0.	0.	2540.	0.	0.	0.	0.	0.	0.	0.	2540.
ONT. MIN. INC. BEF. PROC. ALL.	0.	0.	85729.	102529.	102529.	102529.	102529.	102529.	103219.	104600.	806190.
ONT. MIN. PROC. ALLOW (8%)	0.	0.	12859.	15379.	15379.	15379.	15379.	15379.	15483.	15690.	120929.
ONT. MIN. TAXABLE INC.	0.	0.	72149.	87149.	87149.	87149.	87149.	87149.	87736.	88910.	685262.
ONT. MIN. TAX	0.	0.	20273.	24557.	24557.	24557.	24557.	24557.	24733.	25086.	192878.
CAP. EXPEND.	13810.	13810.	0.	0.	0.	0.	0.	0.	0.	0.	27620.
CASH FLOW	-13810.	-13810.	61062.	41918.	41918.	41918.	41918.	41918.	41742.	41390.	326166.
DCF AT 25%	-11048.	-8838.	31264.	17170.	13736.	10989.	8791.	7033.	5603.	4444.	79142.
DCF AT IRR	-6315.	-2888.	5840.	1833.	838.	383.	175.	80.	37.	17.	-0.
NPV AT 25%	-11048.	-19886.	11377.	28547.	42283.	53272.	62063.	69095.	74698.	79142.	389543.

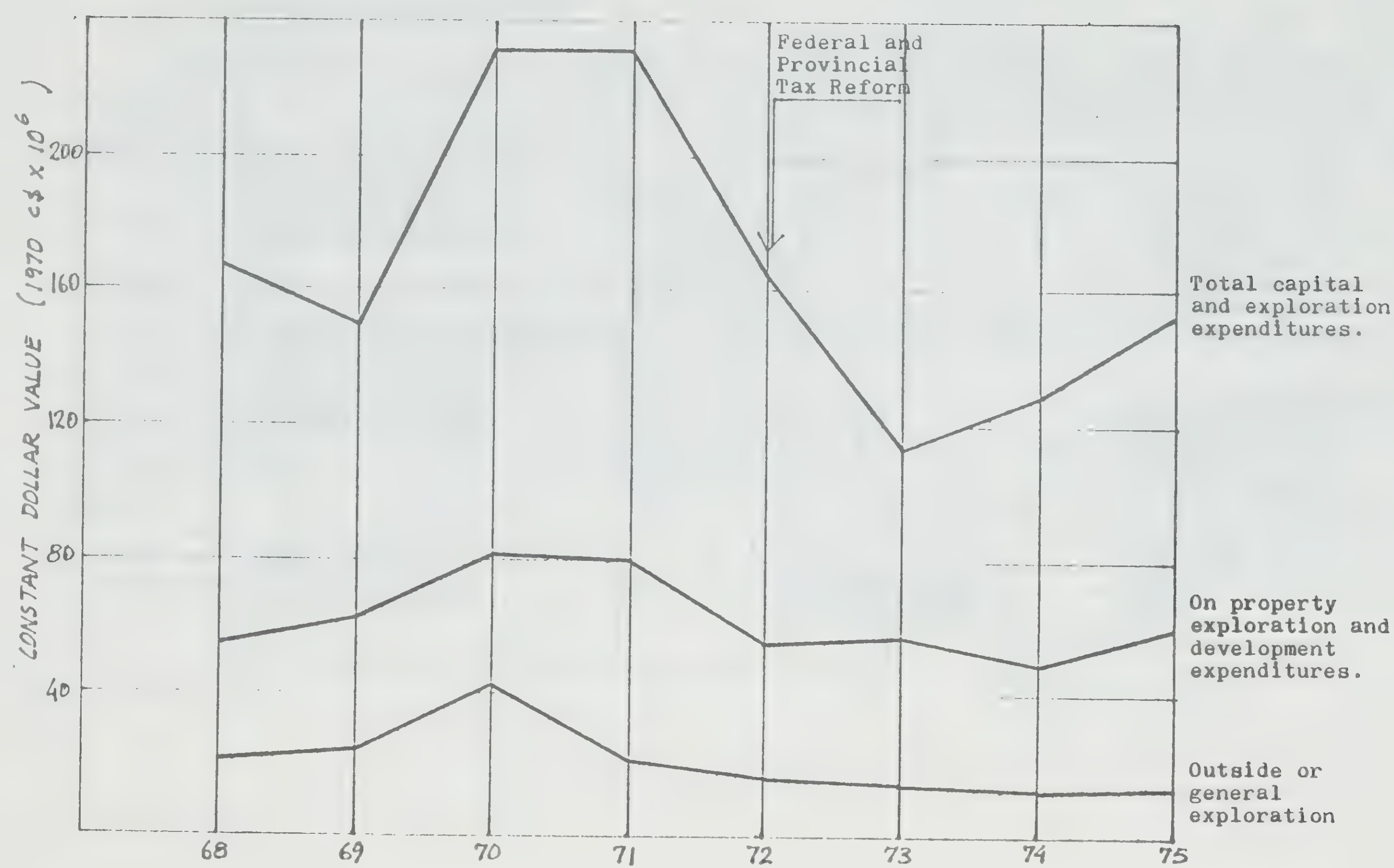
RATE OF RETURN 118.67% PV RATIO AT 25.00% = 3.98 PAYBACK PER: 0.45 YEARS

Fig. 36 Typical Discount Cash Flow Analysis

Fig 37

IMPACT OF TAX CHANGES ON EXPLORATION IN ONTARIO FOR THE PERIOD 1968-75

Data from J.H. DeYoung.



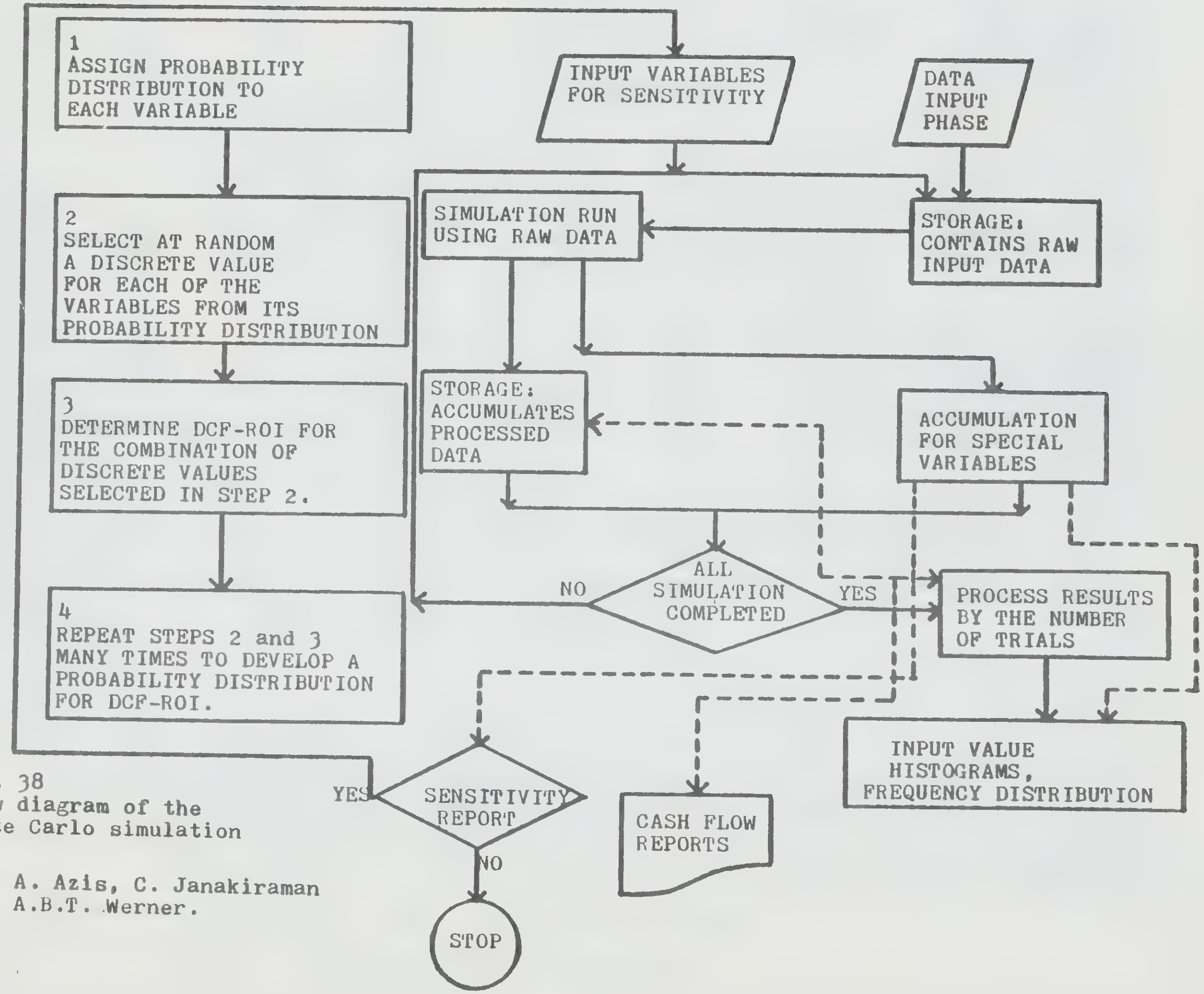


Fig. 38
Flow diagram of the
Monte Carlo simulation

Ref. A. Azis, C. Janakiraman
A.B.T. Werner.

Table 18A

MINIMUM EXPECTED VALUES OF IRR
AND ASSOCIATED PROBABILITY OF
AT LEAST BEING THAT VALUE

BLOCK N° 1

	Copper		CuZn		CuPbZn		NiCu		Molybdenum		Uranium		Gold		Silver		LiCb		Cobalt	
T/D	C.F.	B.H.	C.F.	B.H.	C.F.	B.H.	C.F.	B.H.	C.F.	B.H.	C.F.	B.H.	C.F.	B.H.	C.F.	B.H.	C.F.	B.H.	C.F.	B.H.
1000	2.8	3.1			4.3	2.4	1.6	1.1	9.6	8.8	6.1	3.8	3.4	4.3			19.5	17.8	85.2	76.8
PROB.	0.15	0.05			0.25	0.25	0.1	0.05	0.5	0.3	0.45	0.4	0.3	0.1			0.85	0.75	0.85	0.85
2000	7.5	4.3	4.4	3.6	7.4	6.0	4.7	2.4	13.0	10.3	9.4	6.8	6.1	5.1			36.4	29.4	148.4	123.6
PROB.	0.1	0.1	0.2	0.15	0.4	0.35	0.1	0.1	0.35	0.25	0.55	0.55	0.45	0.35			0.75	0.75	0.85	0.85
4000	9.9	5.7	8.6	9.0	12.7	13.8	5.6	6.8	22.0	10.0	12.6	11.8	10.5	9.4	1.9	2.3	57.6	46.1	185.3	146.5
PROB.	0.1	0.1	0.2	0.15	0.3	0.2	0.1	0.05	0.05	0.05	0.5	0.4	0.35	0.3	0.05	0.05	0.7	0.75	0.75	0.75
8000			3.8	3.3	7.3	7.2					7.6	7.3	15.6	8.4			54.3	52.3	194.2	140.1
PROB.			0.45	0.55	0.7	0.75					0.75	0.8	0.25	0.4			0.7	0.55	0.7	0.7

LEGEND:
C.F. CUT & FILL
B.H. BLAST HOLE

Table 18C

OPEN PIT

BLOCK N° 1

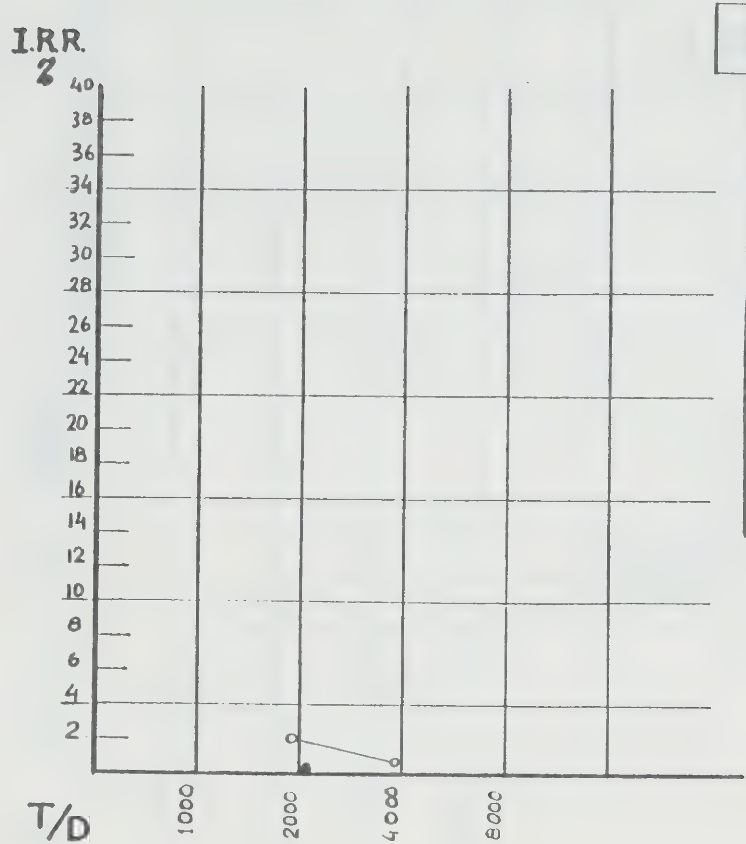
MINIMUM EXPECTED VALUES OF IRR
AND ASSOCIATED PROBABILITY OF
AT LEAST BEING THAT VALUE

T/D \ METAL	Copper	CuZn	CuPbZn	NiCu	Mo.	Uranium	Gold	LiCb	Cobalt	Silver	Iron
4000	16.2	14.1	21.2	16.7	29.7	19.0	11.4	102.7	337.6		2.0
PROB.	0.6	0.75	0.8	0.5	0.45	0.85	0.5	0.8	0.8		0.1
8000	19.8	19.3	24.3	16.4	19.3	24.9	22.0	130.9	421.5	8.2	3.4
PROB.	0.2	0.5	0.6	0.35	0.2	0.8	0.55	0.75	0.7	0.05	0.45
16000	16.9	35.8	47.2	18.6		35.3	37.2	133.2			10.0
PROB.	0.05	0.55	0.7	0.1		0.8	0.55	0.6			0.55
32000											15.4
PROB.											0.65

Fig 39

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 1



METAL: Copper
METHOD: — Cut & Fill
--- Blast Hole

LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
■ □ 75 %
▲ × 50 %
● ○ 25 %

Fig 39

Fig. 40

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 1

METAL: CuZn
METHOD: — Cut & Fill
--- Blast Hole

LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
■ □ 75 %
▲ × 50 %
● o 25 %

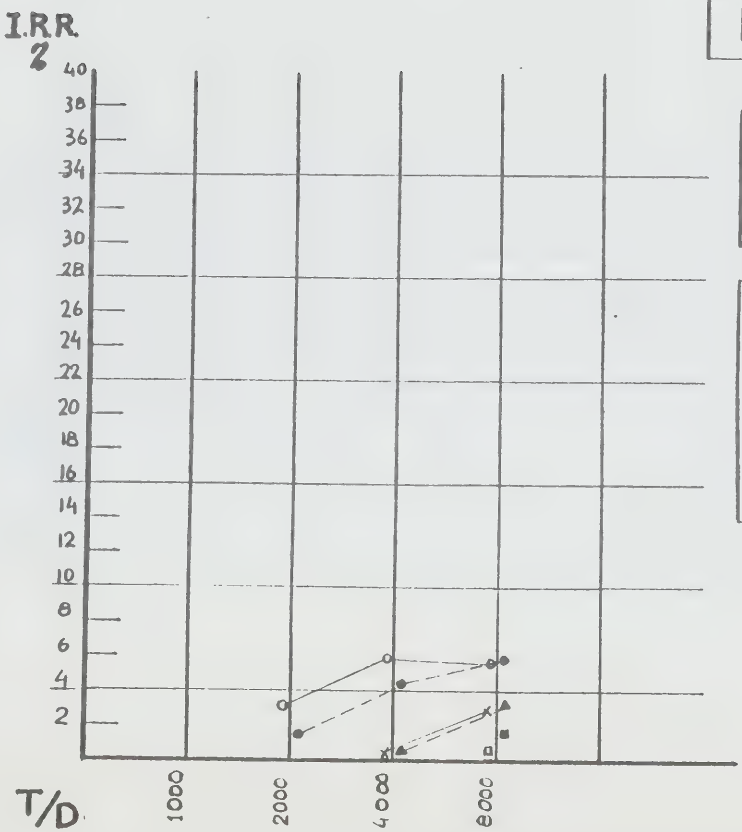
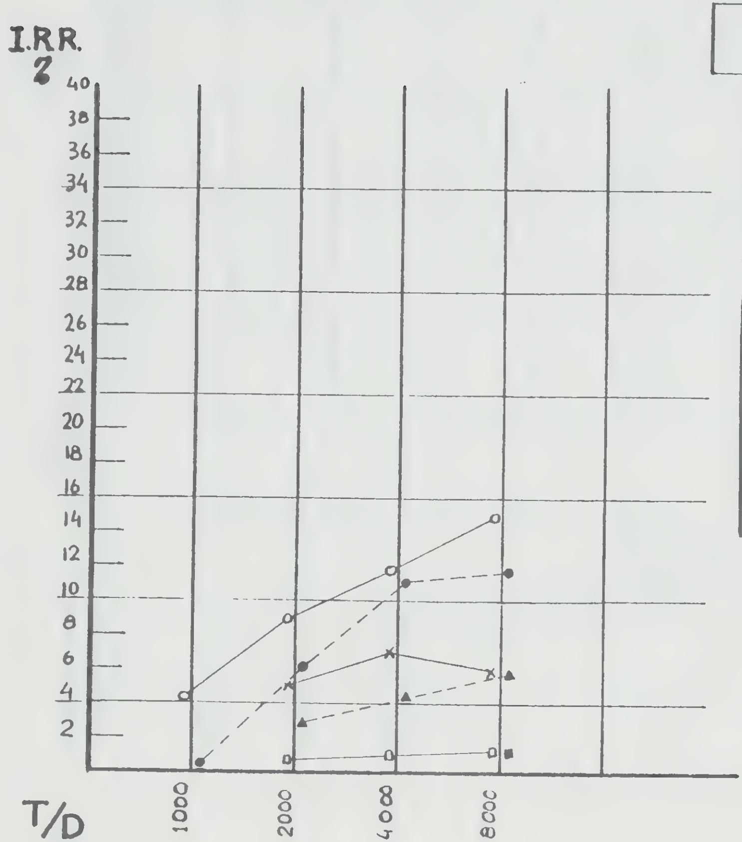


Fig 40

Fig. 41

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 1



METAL: Gold
METHOD: — Cut & Fill
--- Blast Hole

LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
■ □ 75 %
▲ × 50 %
● ○ 25 %

Fig. 41

Fig 42

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 1

METAL: Molybdenum
METHOD: — Cut & Fill
--- Blast Hole

LEGEND:
SIMBOLS INDKATE I.R.R.
@ PROBABILITY 25, 50, 75 %
■ □ 75 %
▲ × 50 %
● ○ 25 %

Fig 42

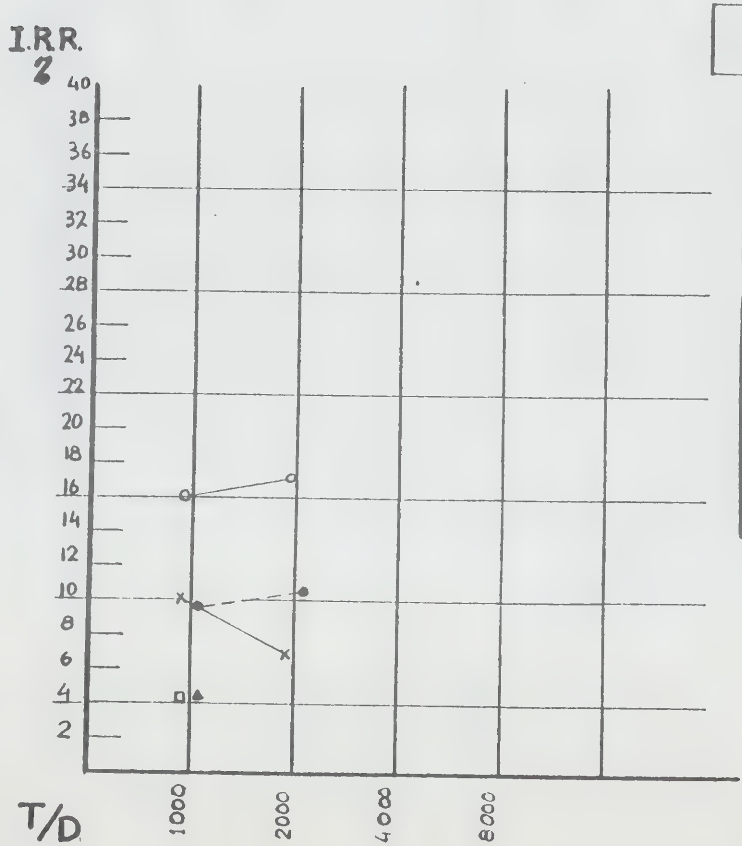


Fig. 43

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 1

METAL: Uranium
METHOD: ---- Blast Hole
—— Cut & Fill

LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
■ □ 75 %
▲ × 50 %
● ○ 25 %

Fig. 43

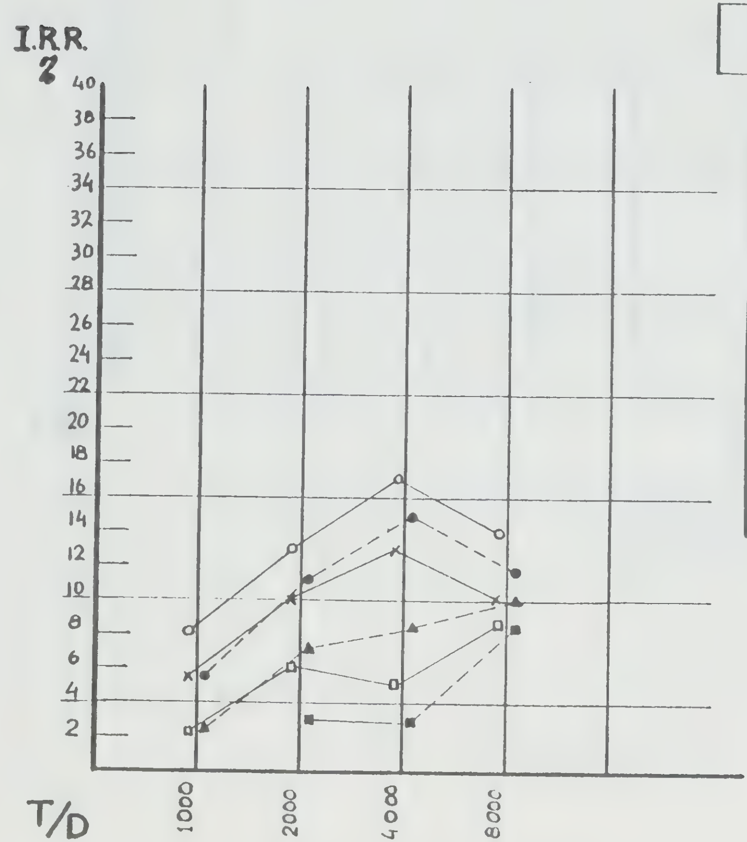


Fig. 4.4

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 1

METAL: CuPbZn
METHOD: — Cut & Fill
--- Blast Hole

LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
■ □ 75 %
▲ × 50 %
● o 25 %

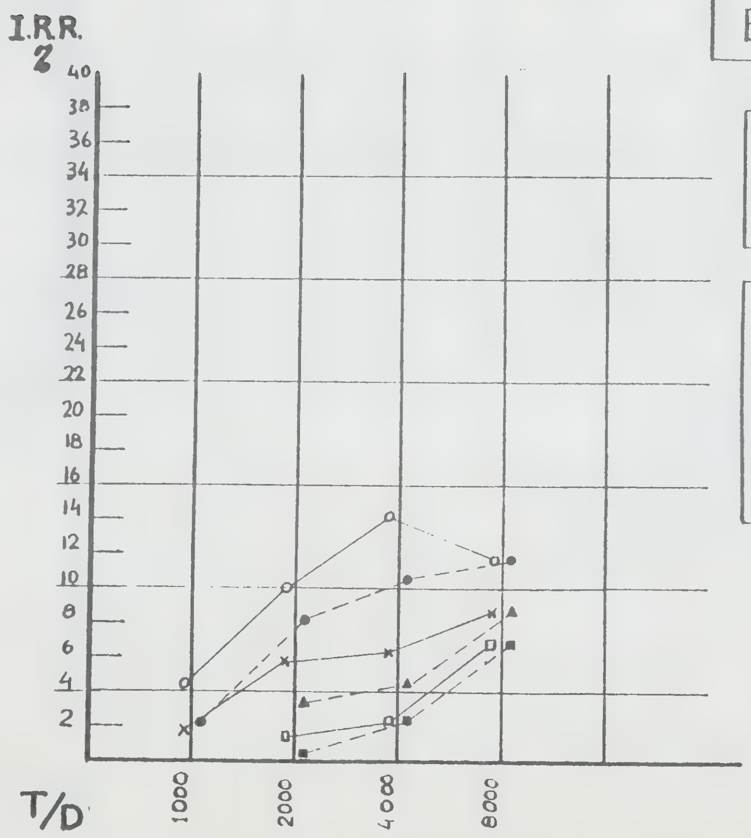


Fig. 4.4.

Fig. 45

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

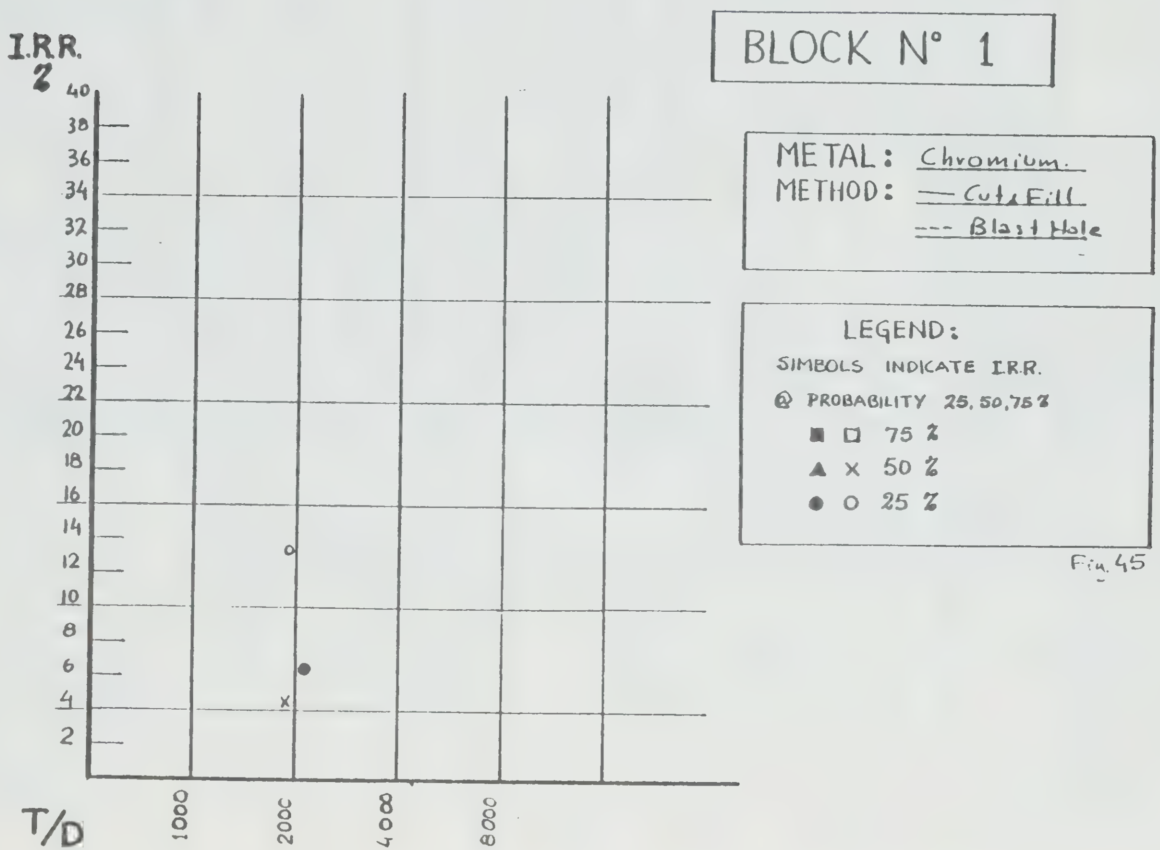


Fig. 45

Table 19A

MINIMUM EXPECTED VALUES OF IRR
AND ASSOCIATED PROBABILITY OF
AT LEAST BEING THAT VALUE

BLOCK N° 2

	CuZn		CuPbZn		PbZn		NiCu		Uranium		Gold		Silver		LiCb					
T/D	C.F.	B.H.	C.F.	B.H.	C.F.	B.H.	C.F.	B.H.	C.F.	B.H.	C.F.	B.H.	C.F.	B.H.	C.F.	B.H.	C.F.	B.H.	C.F.	B.H.
1000	2.6	.2	5.5	5.4	2.8	1.7	2.9	2.0	18.4	15.8	5.3	3.9			24.4	21.5				
PROB.	0.05	0.05	0.6	0.4	0.1	0.05	0.1	0.05	0.85	0.85	0.4	0.4			0.85	0.8				
2000	3.2	2.3	7.0	7.1	3.3	3.0	3.3	3.1	19.8	17.3	5.1	3.8			38.8	31.8				
PROB.	0.15	0.15	0.7	0.6	0.25	0.2	0.25	0.2	0.85	0.9	0.4	0.4			0.75	0.7				
4000	3.4	3.6	9.6	9.0	6.3	5.5	5.2	5.6	31.5	29.5	9.4	8.4	20	3.1	38.5	35.8				
PROB.	0.4	0.35	0.7	0.75	0.2	0.2	0.45	0.45	0.85	0.85	0.4	0.4	0.1	0.05	0.65	0.55				
8000	6.3	6.4	18.9	13.9	7.0	6.4	9.3	9.0	62.9	55.1	13.4	110	46	5.3	37.5	32.4				
PROB.	0.5	0.55	0.5	0.85	0.2	0.2	0.6	0.65	0.8	0.8	0.4	0.35	0.15	0.15	0.3	0.2				

LEGEND:
C.F. CUT & FILL
B.H. BLAST HOLE

Table 19B

OPEN PIT

BLOCK N° 2

MINIMUM EXPECTED VALUES OF IRR
AND ASSOCIATED PROBABILITY OF
AT LEAST BEING THAT VALUE

T/D \ METAL	CuZn	CuPbZn	PbZn	NiCu	Mo.	Uranium	Gold	Silver	LiCb	Iron	
4000	7.9	14.6	11.8	11.6	6.5	51.6	14.0	2.9	96.0	1.7	
PROB.	0.6	0.75	0.6	0.7	0.05	0.85	0.35	0.05	0.7	0.1	
8000	11.9	20.5	20.4	17.4		121.0	30.6	7.3	86.0	4.9	
PROB.	0.7	0.85	0.65	0.85		0.8	0.35	0.1	0.6	0.3	
16000	29.8	54.0	26.3	24.1		136.3	30.1	6.7		8.5	
PROB.	0.7	0.85	0.45	0.9		0.9	0.4	0.3		0.6	
32000										14.4	
PROB.										0.65	

Fig. 46

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 2

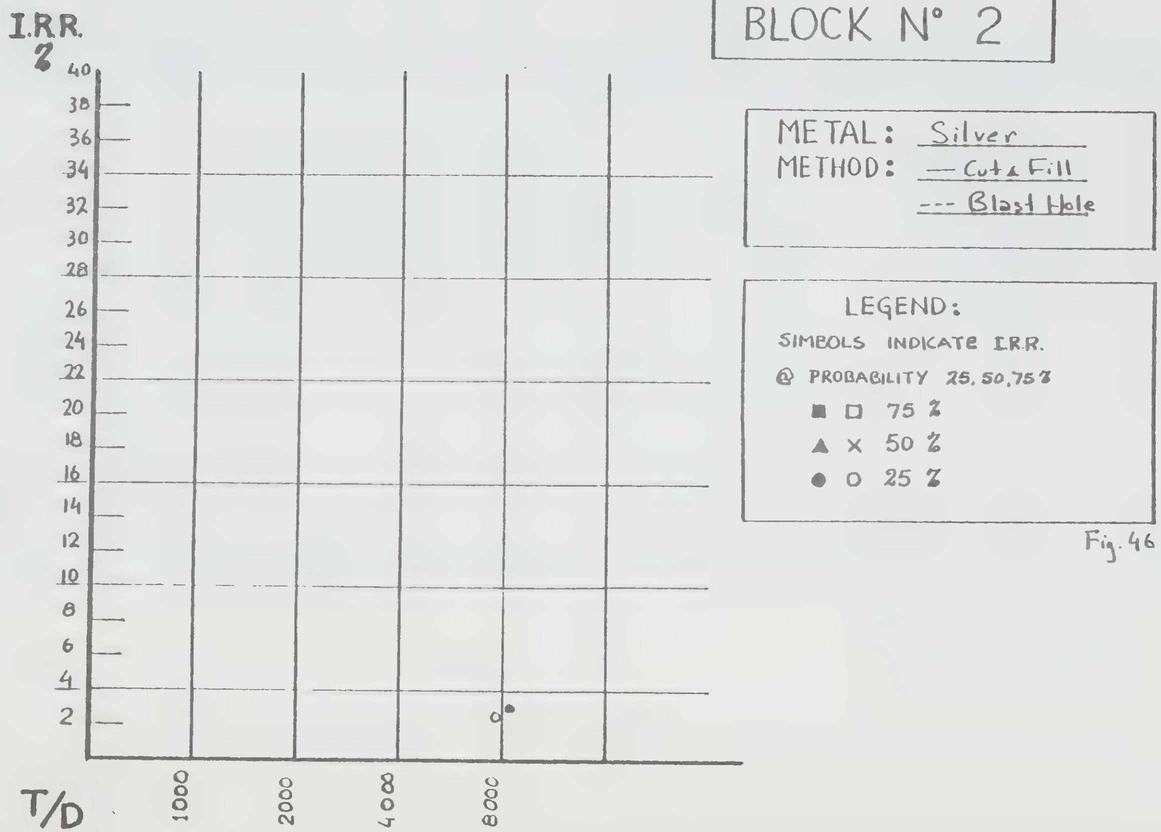


Fig. 46

Fig. 47

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

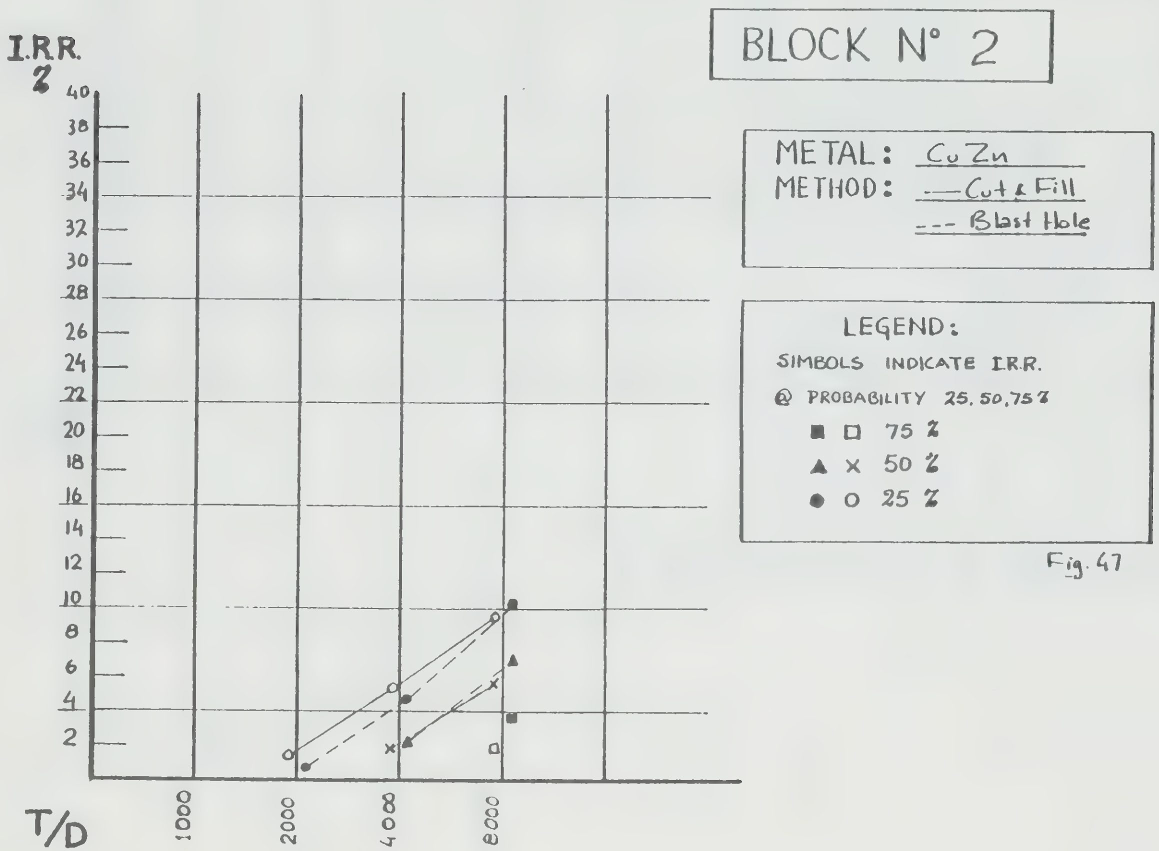


Fig. 47

Fig. 48

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 2

METAL: Gold
METHOD: — Cut & Fill
--- Blast Hole

LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
■ □ 75 %
▲ × 50 %
● o 25 %

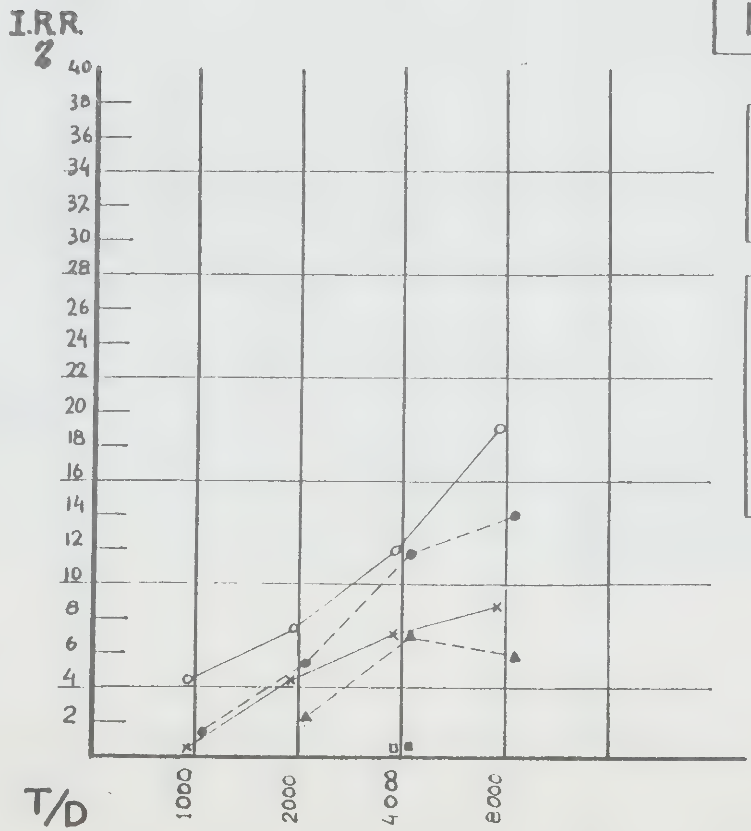


Fig. 48

Fig. 49

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 2

METAL: Ni Cu
METHOD: — Cut & Fill
--- Blast Hole.

LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
■ □ 75 %
▲ × 50 %
● ○ 25 %

Fig. 49

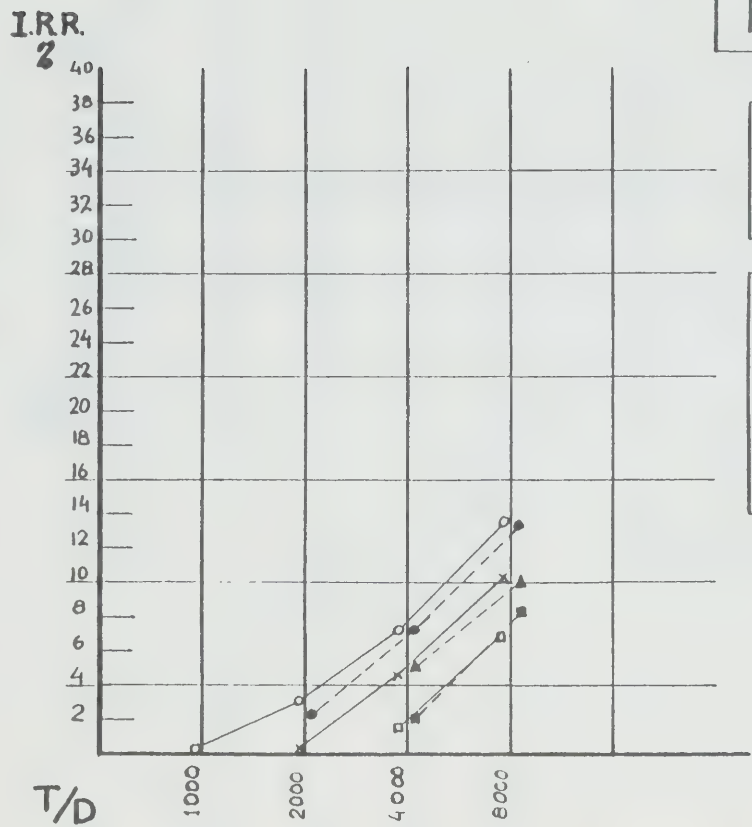


Fig 50

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 2

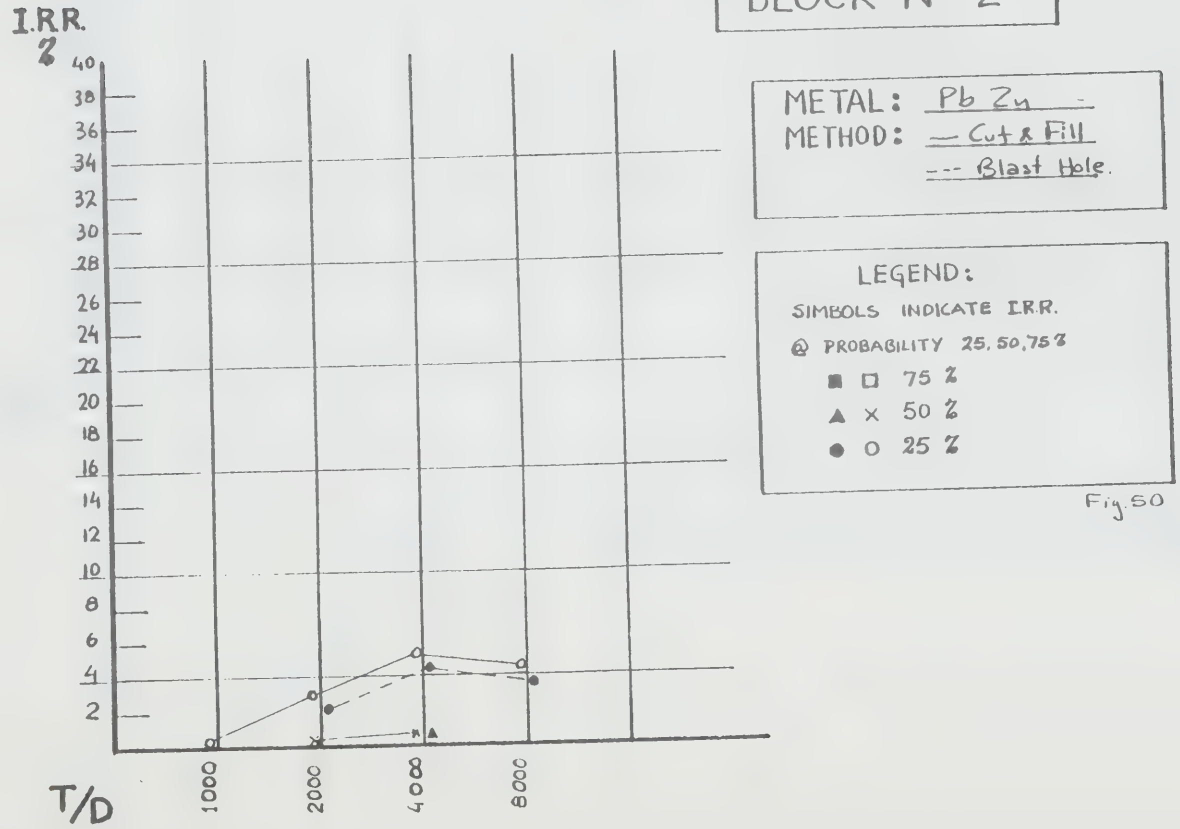


Fig. 50

Fig. 51

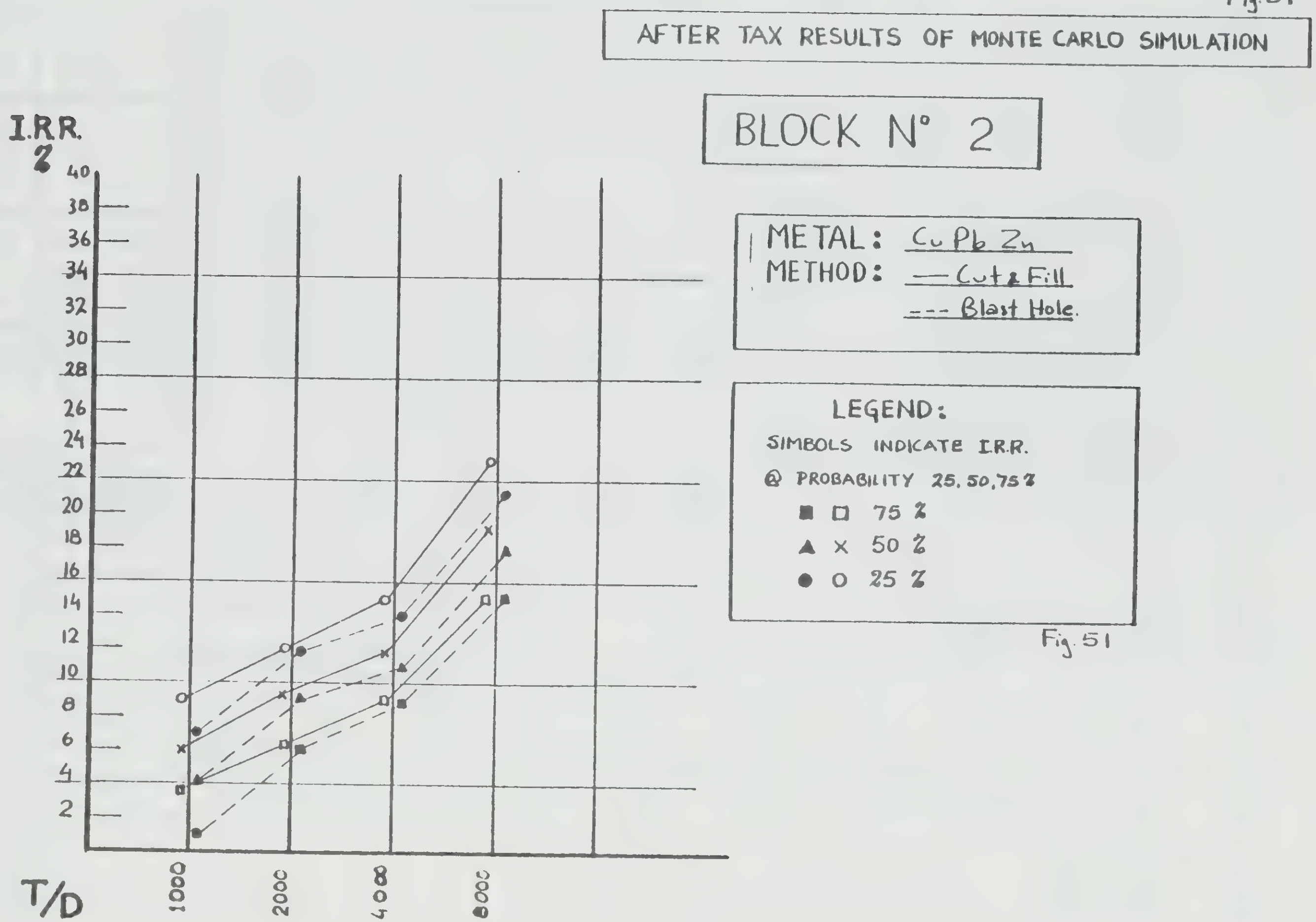

AFTER TAX RESULTS OF MONTE CARLO SIMULATION
BLOCK N° 2
METAL: Cu Pb Zn
METHOD: — Cut & Fill
--- Blast Hole.
LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
■ □ 75 %
▲ × 50 %
● ○ 25 %
I.R.R. %
40
38
36
34
32
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
T/D
1000
2000
4000
8000

Fig. 51

Table 20A

MINIMUM EXPECTED VALUES OF IRR
AND ASSOCIATED PROBABILITY OF
AT LEAST BEING THAT VALUE

BLOCK N° 3

	Copper		CuZn		CuPbZn		PbZn		NiCu		Uranium		Gold		Silver		LiCb		Iron	
T/D	C.F.	B.H.	C.F.	B.H.	C.F.	B.H.	C.F.	B.H.	C.F.	B.H.	C.F.	B.H.	C.F.	B.H.	C.F.	B.H.	C.F.	B.H.	C.F.	B.H.
1000	1.2	.4	1.2		7.0	6.4	7.9	6.5	3.5	2.4	16.7	14.7	4.3	5.4	3.8	3.0	27.1	23.6		
PROB.	0.05	0.05	0.05		0.55	0.4	0.7	0.65	0.2	0.15	0.85	0.8	0.4	0.2	0.05	0.05	0.8	0.8		
2000	2.2	.4	3.3	2.4	7.8	7.4	10.0	8.4	4.4	3.4	17.5	16.1	6.6	5.2	4.7	3.2	45.8	38.3		
PROB.	0.05	0.05	0.1	0.1	0.65	0.6	0.7	0.75	0.35	0.35	0.85	0.85	0.45	0.45	0.01	0.01	0.8	0.8		
4000			3.2	2.8	7.9	7.6	10.2	10.0	4.7	5.6	31.6	28.3	9.2	8.3	9.0	4.7	73.8	47.8		
PROB.			0.02	0.25	0.75	0.75	0.75	0.75	0.45	0.4	0.85	0.85	0.6	0.6	0.1	0.15	0.7	0.8		
8000			5.2	4.7	110	11.9	14.3	14.5	7.8	7.6	53.4	45.6	14.4	14.3	17.1	11.4	81.6	60.1	.6	1.2
PROB.			0.4	0.45	0.85	0.8	0.8	0.8	0.6	0.65	0.75	0.75	0.65	0.6	0.05	0.05	0.55	0.55	0.05	0.05

LEGEND:
C.F. CUT & FILL
B.H. BLAST HOLE

Table 20B

OPEN PIT

BLOCK N° 3

MINIMUM EXPECTED VALUES OF IRR
AND ASSOCIATED PROBABILITY OF
AT LEAST BEING THAT VALUE

METAL / T/D	Copper	CuZn	CuPbZn	PbZn	NiCu	Uranium	Gold	Silver	LiCb	Iron	
4000	10.8	10.8	21.7	26.5	16.0	61.8	11.6	11.1	122.2	2.9	
PROB.	0.3	0.55	0.65	0.65	0.6	0.75	0.45	0.1	0.8	0.05	
8000	11.7	14.6	20.7	26.1	16.3	107.2	18.5	14.9	155.1	4.7	
PROB.	0.15	0.5	0.7	0.65	0.65	0.8	0.7	0.2	0.7	0.35	
16000	6.4	24.3	30.0	39.0	31.8	116.2	40.8	23.3	162.4	8.2	
PROB.	0.05	0.55	0.8	0.7	0.7	0.8	0.65	0.1	0.55	0.6	
32000										14.4	
PROB.										0.65	

Fig 52

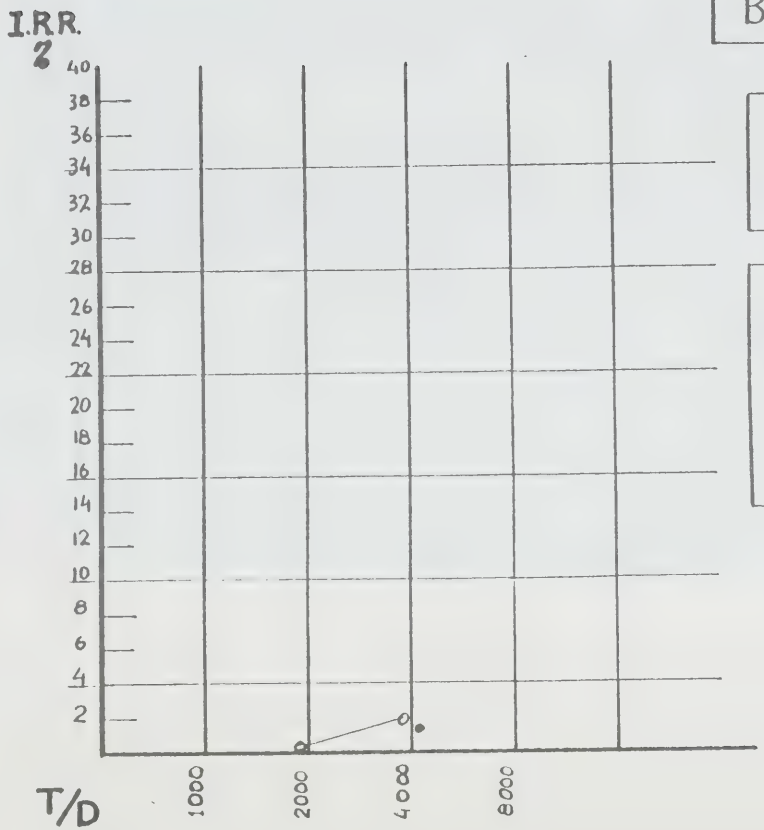
AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 3

METAL: Silver
METHOD: — Cut & Fill
--- Blast Hole

LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
■ □ 75 %
▲ × 50 %
● ○ 25 %

Fig 52



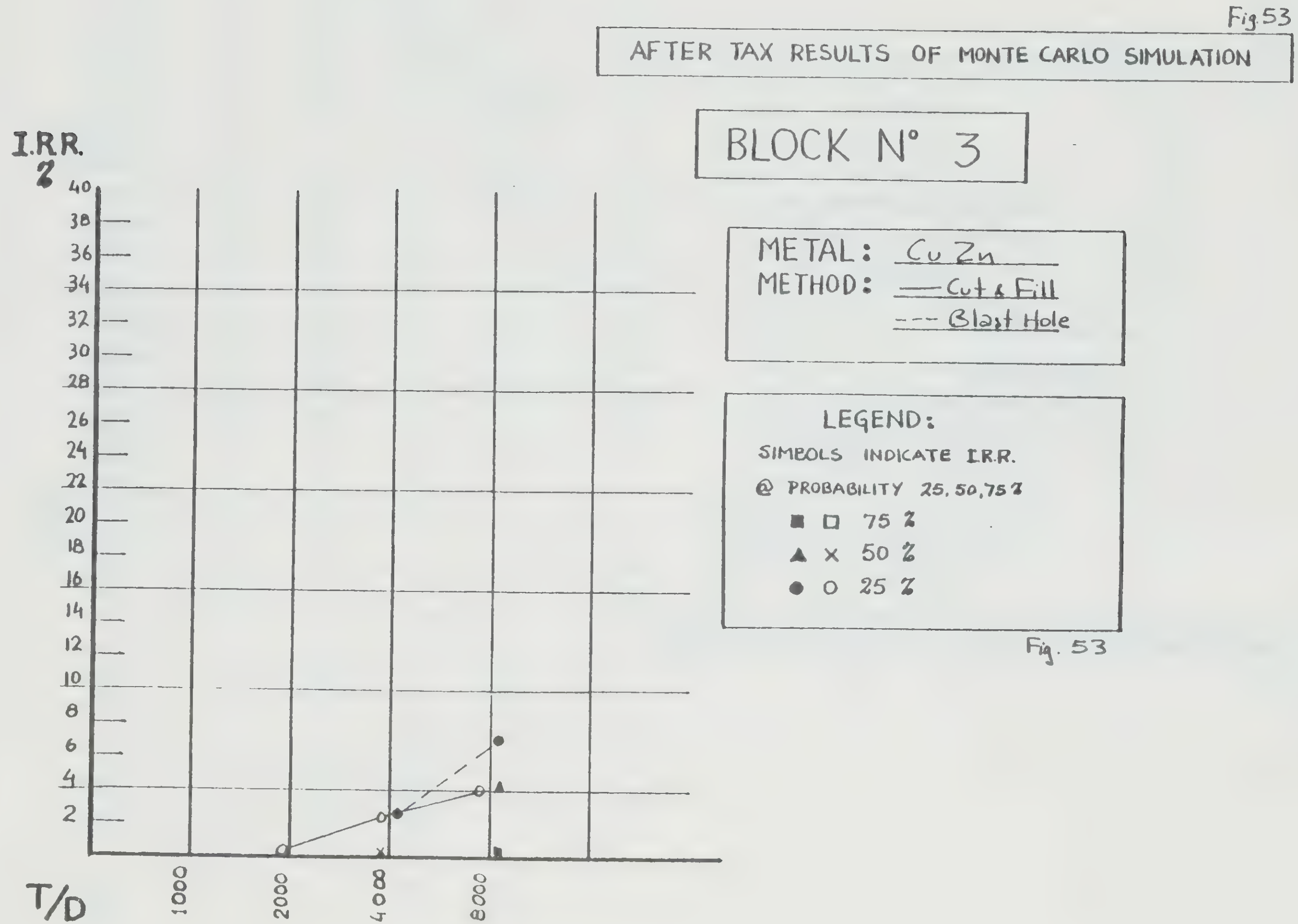


Fig.53
AFTER TAX RESULTS OF MONTE CARLO SIMULATION
BLOCK N° 3
METAL: Cu Zn
METHOD: —— Cut & Fill
--- Blast Hole
LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
■ □ 75 %
▲ × 50 %
● ○ 25 %
Fig. 53
I.R.R. %
40
38
36
34
32
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
T/D
1000
2000
4008
8000

Fig 54

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 3

METAL: Gold
METHOD: — Cut & Fill
--- Blast Hole

LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
■ □ 75 %
▲ × 50 %
● ○ 25 %

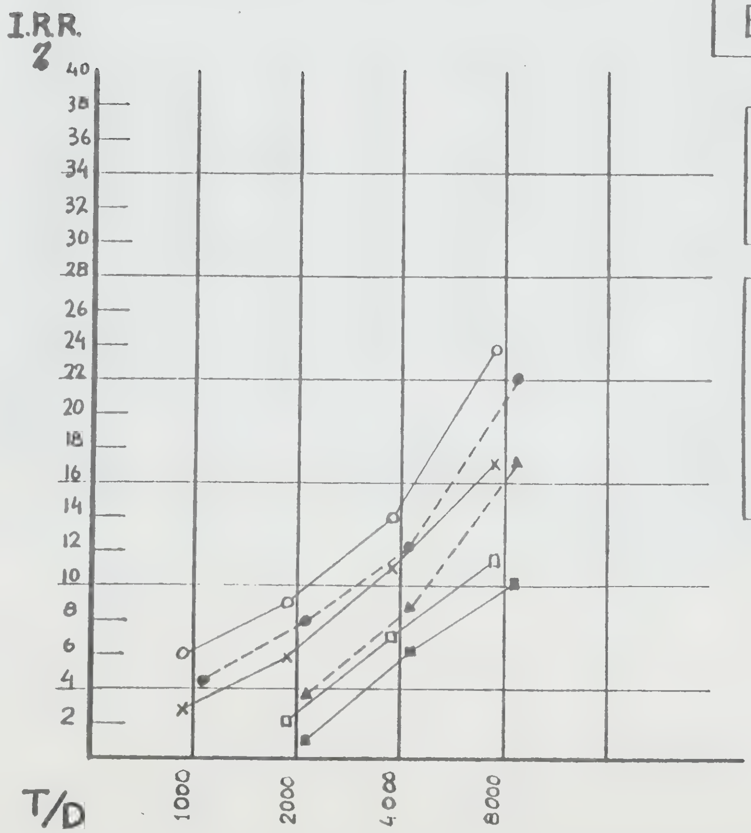


Fig. 54

Fig 55

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 3

METAL: Ni Cu
METHOD: — Cut & Fill
--- Blast Hole

LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
■ □ 75 %
▲ × 50 %
● ○ 25 %

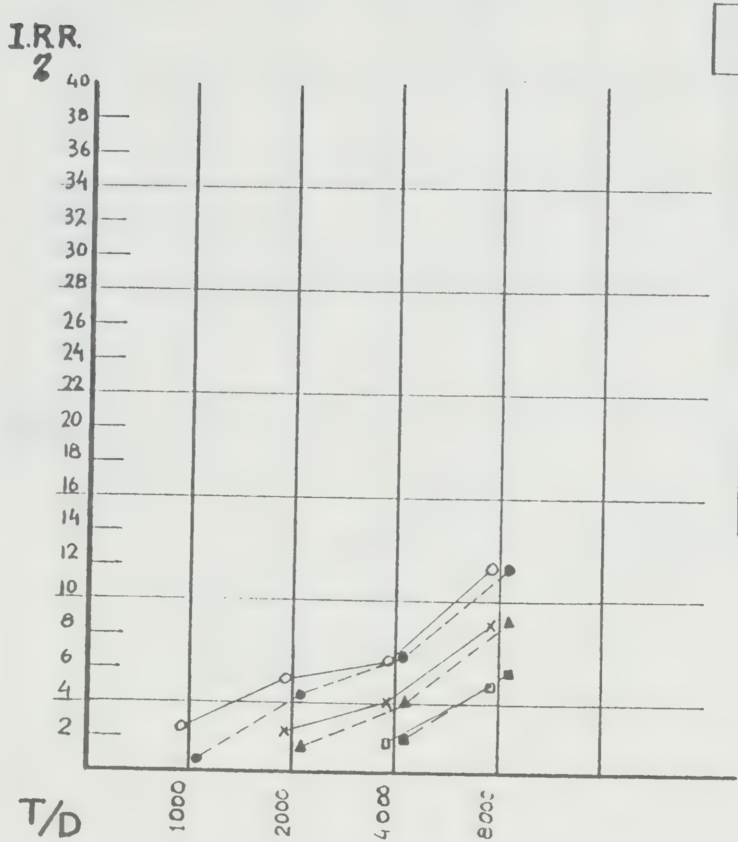
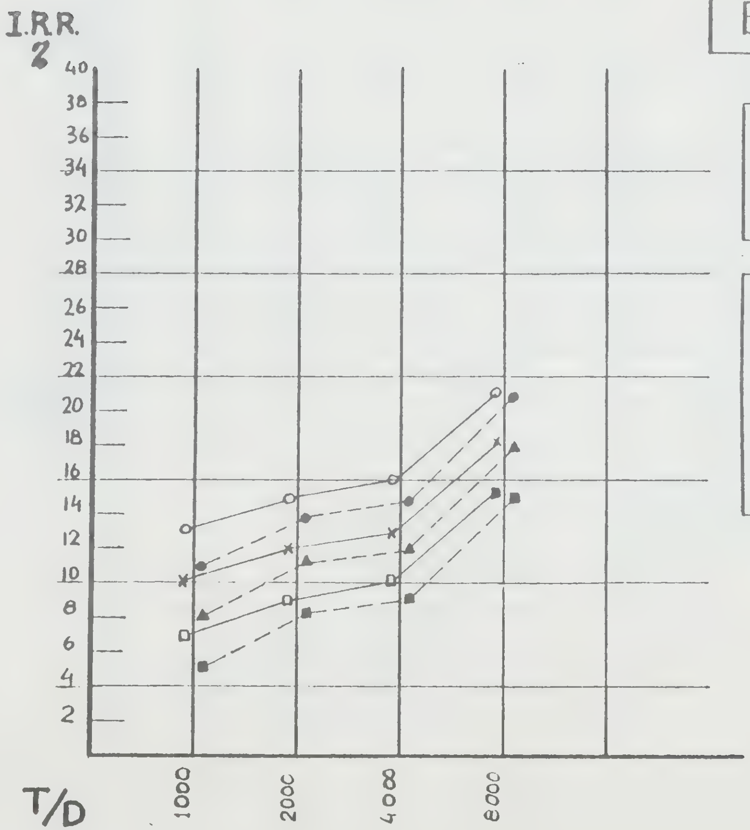


Fig. 55

Fig. 56

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 3



METAL: PbZn
METHOD: — Cut & Fill
--- Blast Hole

LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
■ □ 75 %
▲ × 50 %
● ○ 25 %

Fig. 56

Fig.57

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 3

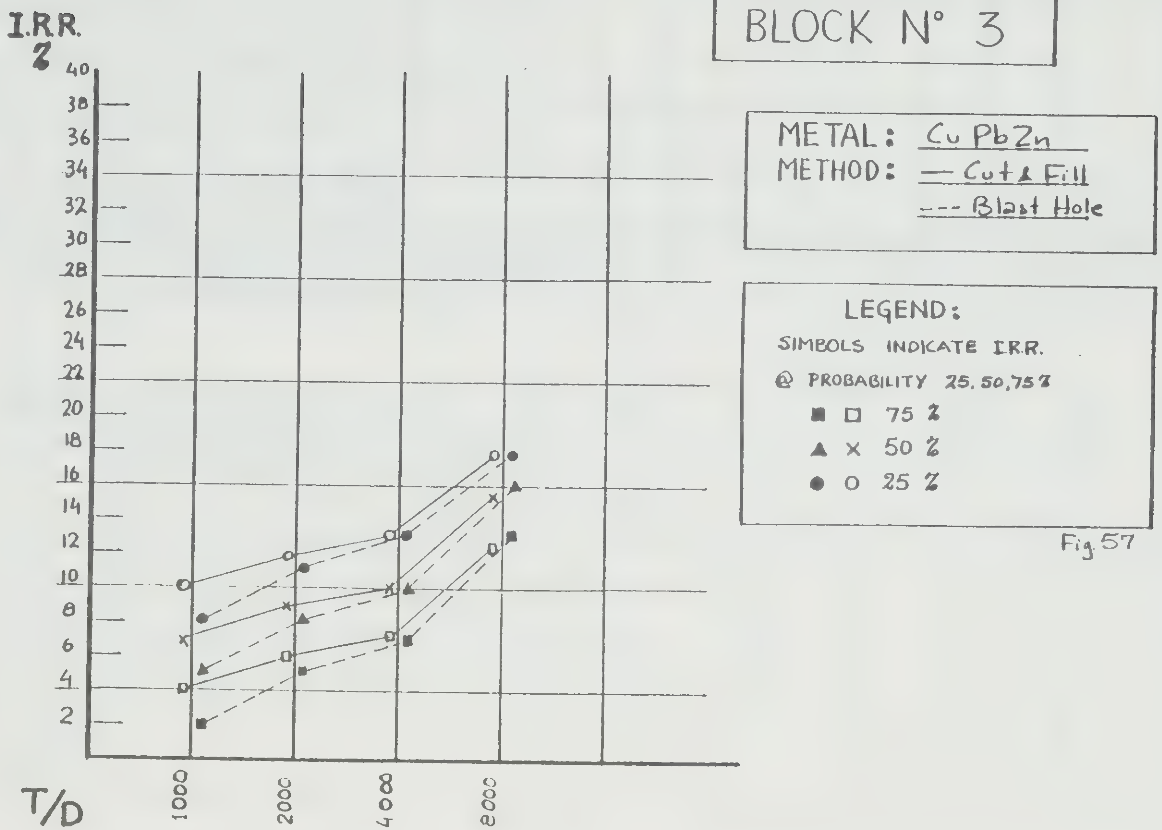


Fig. 57

MINIMUM EXPECTED VALUES OF IRR
AND ASSOCIATED PROBABILITY OF
AT LEAST BEING THAT VALUE

Table 21A

BLOCK N°4

	CuZn		CuPbZn		PbZn		Diamonds		Coal											
T/D	C.F.	B.H.	C.F.	B.H.	C.F.	B.H.	C.F.	B.H.	C.F.	B.H.	C.F.	B.H.	C.F.	B.H.	C.F.	B.H.	C.F.	B.H.	C.F.	B.H.
1000	3.4	2.3	8.3	6.5	8.3	6.0														
PROB.	0.25	0.15	0.7	0.6	0.7	0.7														
2000	5.5	5.0	11.5	10.3	11.7	10.5	2.5	2.2												
PROB.	0.45	0.35	0.8	0.75	0.8	0.75	0.15	0.1												
4000	8.0	7.6	16.9	14.3	15.4	14.4	4.1	4.2												
PROB.	0.4	0.35	0.8	0.85	0.85	0.85	0.35	0.35												
8000	11.1	10.9	26.3	22.2	20.1	18.6	6.6	6.6	.9	1.9										
PROB.	0.25	0.25	0.75	0.8	0.85	0.85	0.45	0.5	0.05	0.05										

LEGEND:
C.F. CUT & FILL
B.H. BLAST HOLE

Table 21 B

OPEN PIT

BLOCK N° 4

MINIMUM EXPECTED VALUES OF IRR
AND ASSOCIATED PROBABILITY OF
AT LEAST BEING THAT VALUE

METAL / T/D	CuZn	CuPbZn	PbZn	Coal	Diamonds						
4000	17.6	25.7	24.6	3.3	10.0						
PROB.	0.75	0.9	0.9	0.15	0.7						
8000	29.3	51.3	27.2	3.9	11.6						
PROB.	0.65	0.8	0.9	0.45	0.8						
16000	28.4	73.1	30.6	4.7	20.6						
PROB.	0.45	0.8	0.85	0.55	0.8						
32000											
PROB.											

Fig. 58

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 4

METAL: Diamonds
METHOD: — Cut & Fill
--- Blast Hole

LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
■ □ 75 %
▲ x 50 %
● o 25 %

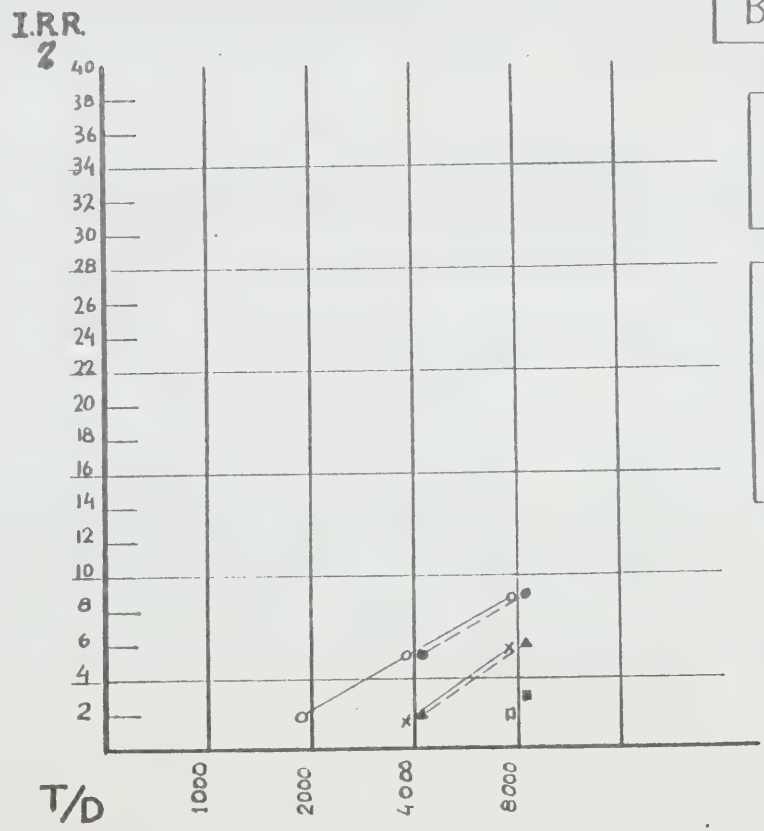


Fig. 58

Fig. 59

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 4

METAL: CuPbZn
METHOD: — Cut & Fill
--- Blast Hole

LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
■ □ 75 %
▲ × 50 %
● ○ 25 %

Fig. 59

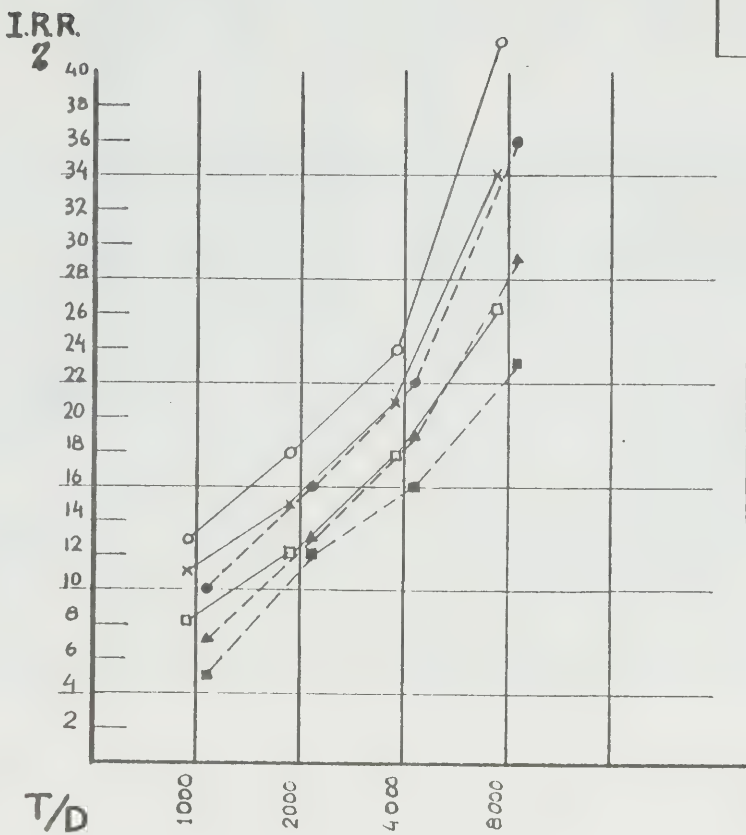


Fig. 60

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

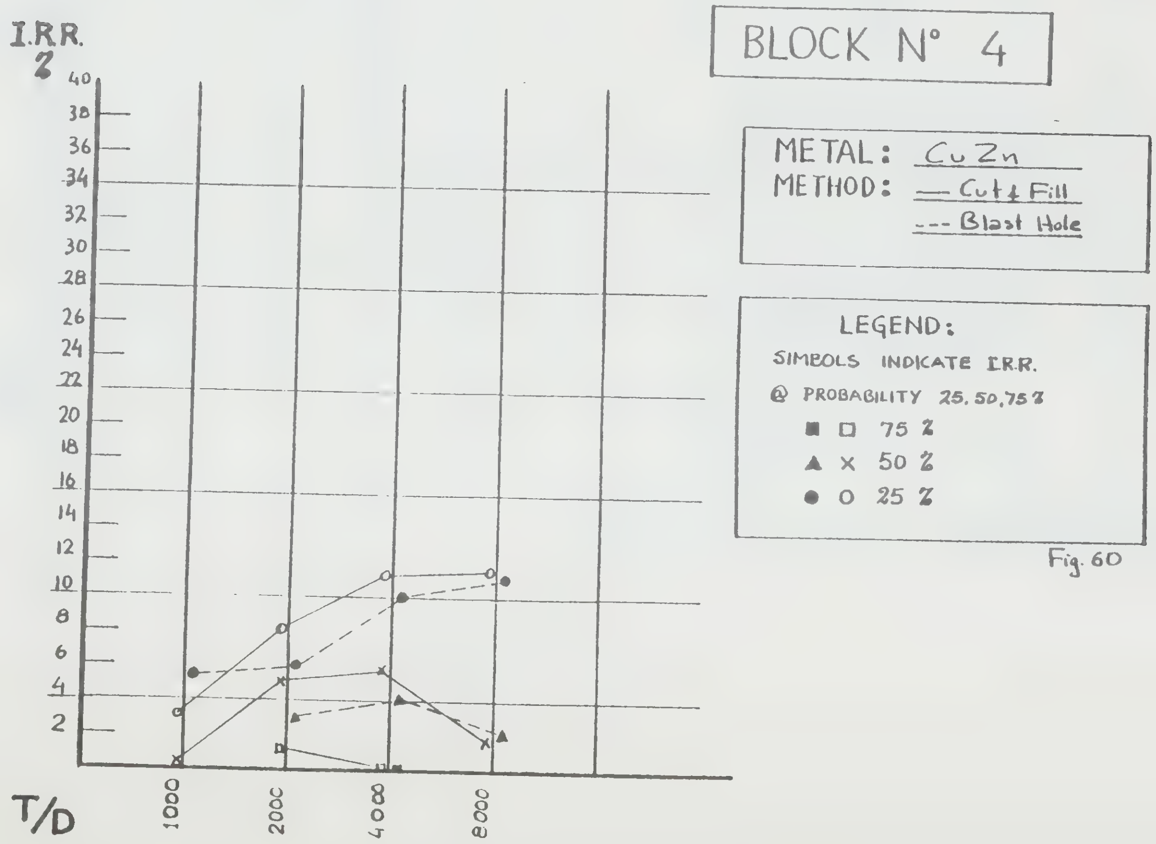


Fig. 60

Table 22A

MINIMUM EXPECTED VALUES OF IRR
AND ASSOCIATED PROBABILITY OF
AT LEAST BEING THAT VALUE

BLOCK N°5

	CuZn		CuPbZn		PbZn		Uranium		Gold		Silver		LiCb		Diamonds					
T/D	C.F.	B.H.	C.F.	B.H.	C.F.	B.H.	C.F.	B.H.	C.F.	B.H.	C.F.	B.H.	C.F.	B.H.	C.F.	B.H.	C.F.	B.H.	C.F.	B.H.
1000	2.9	2.9	9.2	7.3	2.4		6.3	4.8	4.9	5.0	4.1	4.2	27.2	22.1	1.4					
PROB.	0.15	0.05	0.75	0.65	0.05		0.55	0.45	0.3	0.15	0.2	0.1	0.75	0.85	0.05					
2000	4.7	3.0	13.4	11.3	3.2	3.0	8.3	7.2	6.9	5.6	6.1	4.8	29.3	26.0	2.7	2.3				
PROB.	0.25	0.25	0.75	0.75	0.15	0.1	0.7	0.65	0.5	0.45	0.2	0.15	0.9	0.9	0.15	0.1				
4000	7.2	6.8	16.6	16.0	4.9	3.8	13.6	12.3	9.9	5.7	14.4	6.0	36.4	33.9	5.3	3.8				
PROB.	0.2	0.15	0.85	0.8	0.35	0.4	0.65	0.6	0.65	0.8	0.1	0.15	0.9	0.85	0.3	0.4				
8000	9.3	8.8	26.2	23.7	6.2	6.4	14.9	17.1	14.8	14.1	9.8	8.5	41.1	41.5	5.7	6.1				
PROB.	0.1	0.05	0.8	0.8	0.5	0.55	0.65	0.45	0.65	0.6	0.1	0.05	0.95	0.9	0.55	0.55				

LEGEND:
C.F. CUT & FILL
B.H. BLAST HOLE

Table 22B

OPEN PIT

BLOCK N° 5

MINIMUM EXPECTED VALUES OF IRR
AND ASSOCIATED PROBABILITY OF
AT LEAST BEING THAT VALUE

METAL / T/D	Copper	CuZn	CuPbZn	PbZn	Uranium	Gold	Silver	LiCb	Coal	Diamonds	
4000	12.5	16.4	27.2	10.2	24.9	12.6	13.7	53.1		10.2	
PROB.	0.1	0.6	0.9	0.75	0.85	0.55	0.2	0.9		0.7	
8000	2.9	17.1	43.0	13.0	40.3	20.1	19.7	61.8	2.6	13.2	
PROB.	0.05	0.55	0.8	0.8	0.75	0.65	0.15	0.9	0.1	0.7	
16000		16.8	72.6	22.0	43.8	36.2	27.1	133.5	2.5	15.1	
PROB.		0.3	0.9	0.8	0.6	0.7	0.05	0.85	0.05	0.7	
32000											
PROB.											

Fig. 61

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 5

METAL: Diamonds
METHOD: — Cut & Fill
--- Blast Hole

LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
■ □ 75 %
▲ × 50 %
● ○ 25 %

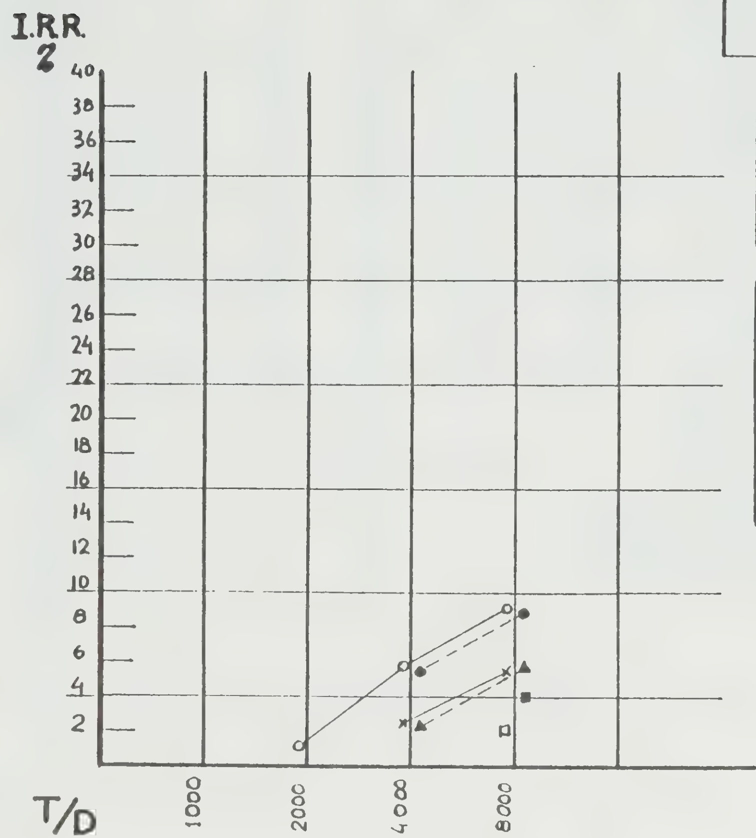


Fig. 61

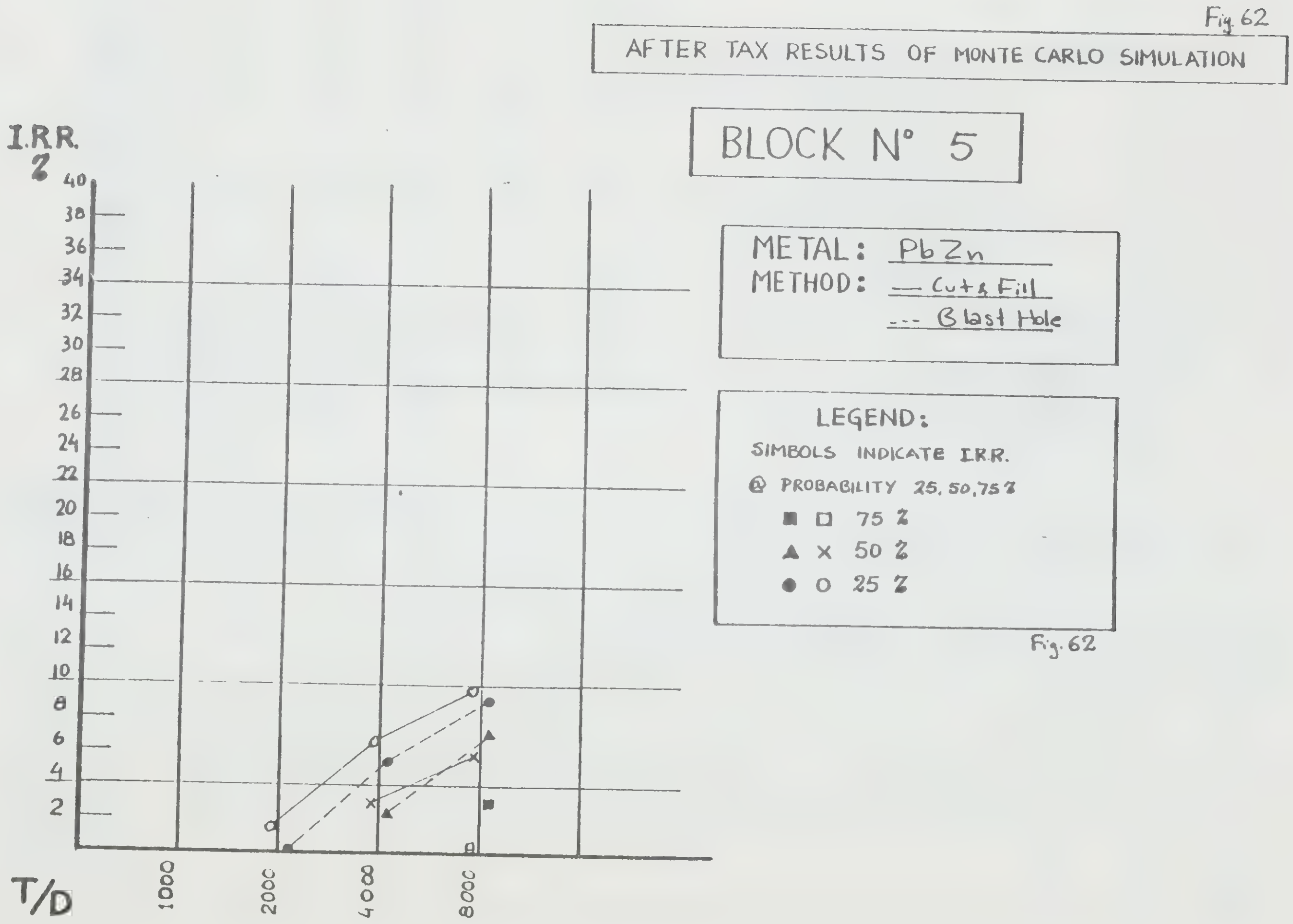


Fig 62
AFTER TAX RESULTS OF MONTE CARLO SIMULATION
BLOCK N° 5
METAL: PbZn
METHOD: — Cut & Fill
--- Blast Hole
LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
■ □ 75 %
▲ × 50 %
● o 25 %
Fig. 62
I.R.R. %
40
38
36
34
32
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
T/D
1000
2000
4000
8000

Fig. 63

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 5

METAL: Silver
METHOD: — Cut & Fill
--- Blast Hole

LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
■ □ 75 %
▲ × 50 %
● o 25 %

Fig. 63

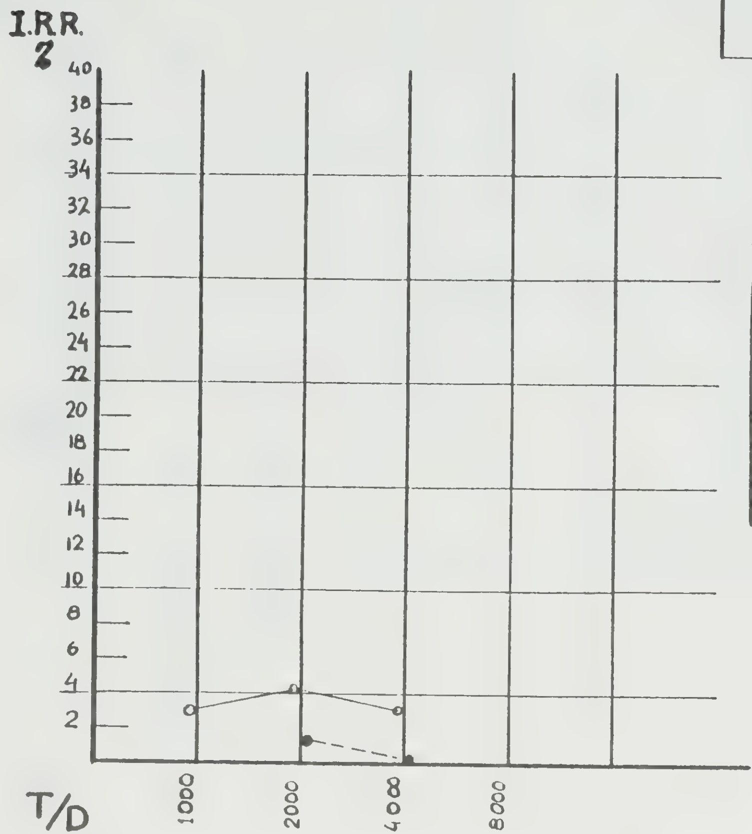


Fig. 64

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

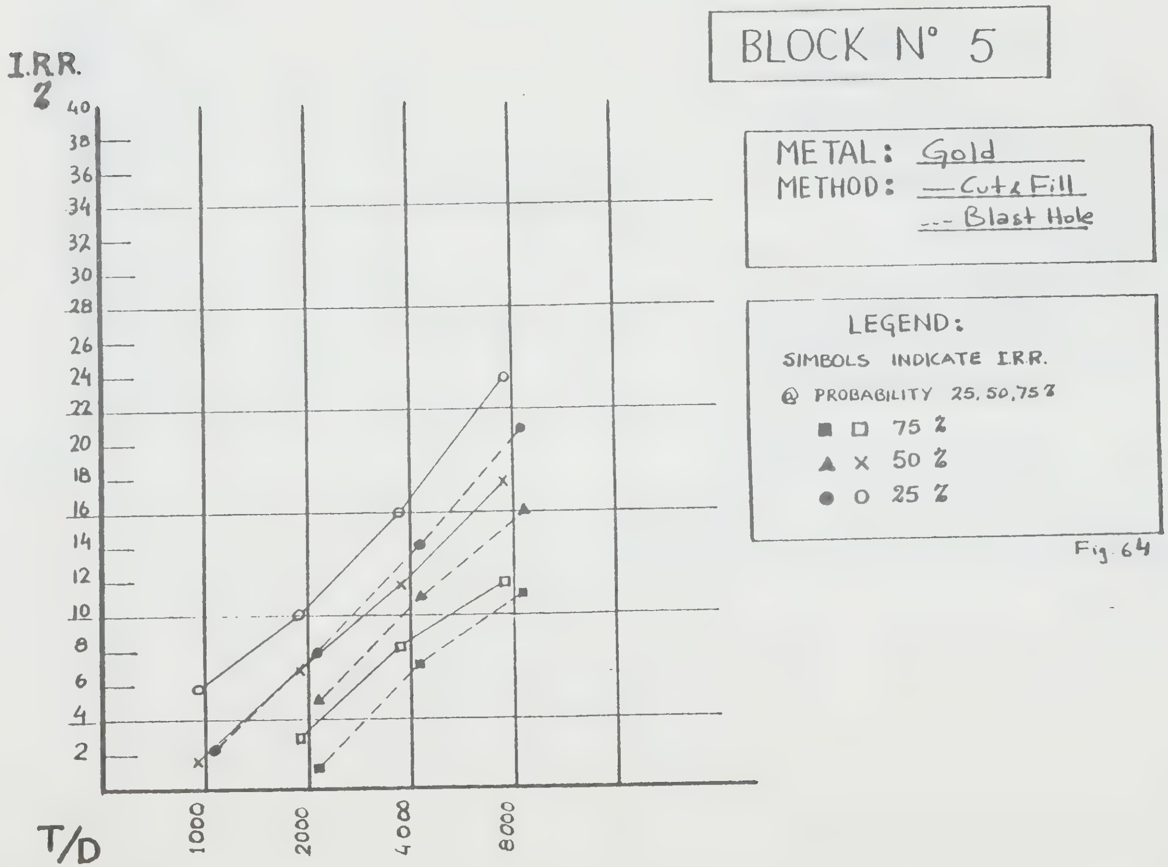


Fig. 65

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 5

METAL: Uranium
METHOD: — Cut & Fill
--- Blast Hole

LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
■ □ 75 %
▲ × 50 %
● ○ 25 %

Fig. 65

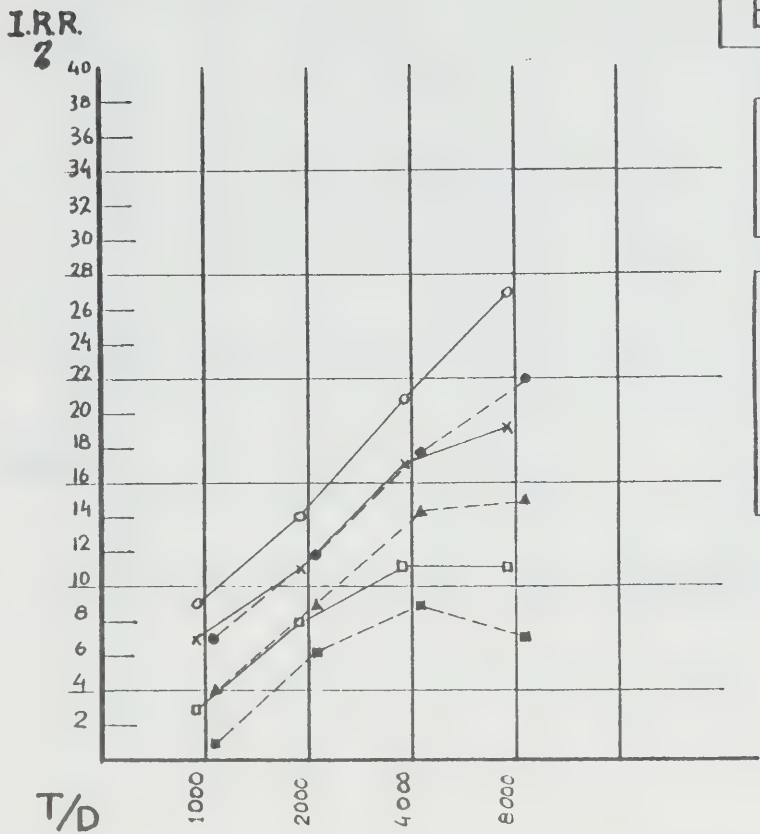


Fig. 66

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

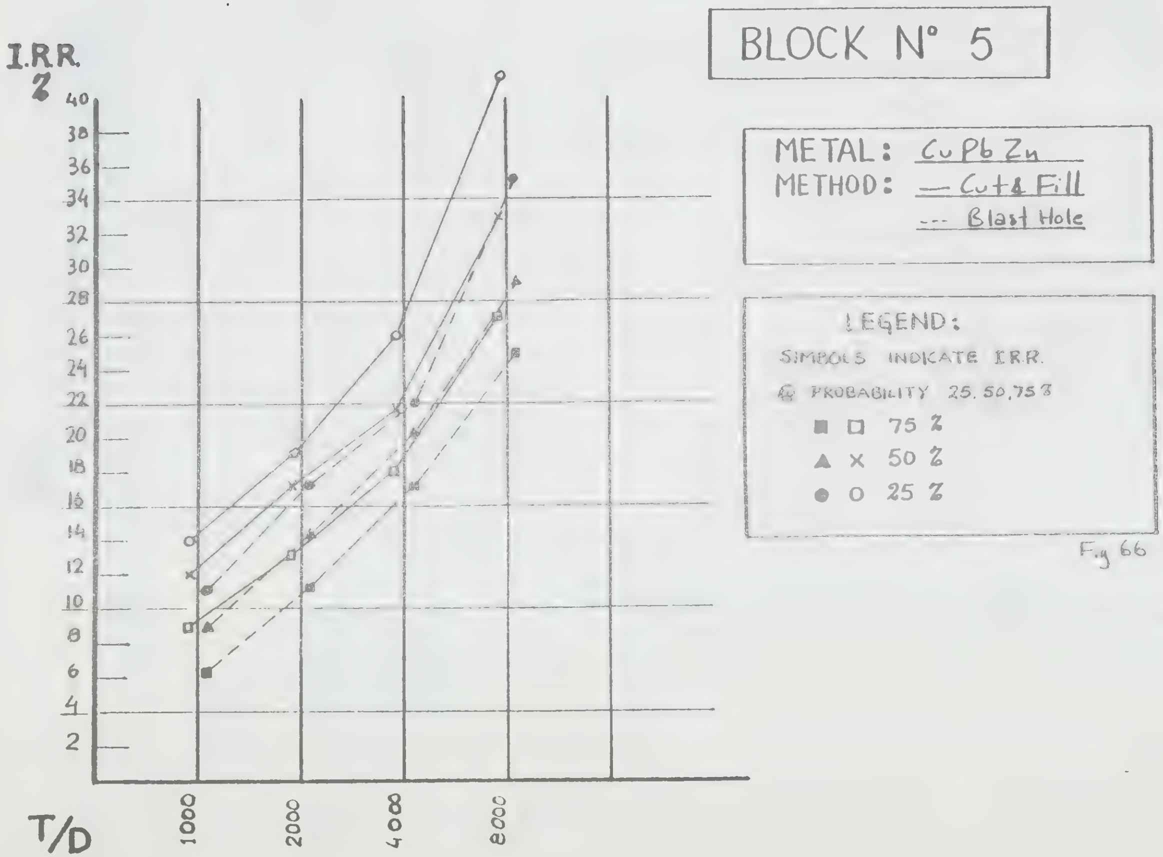
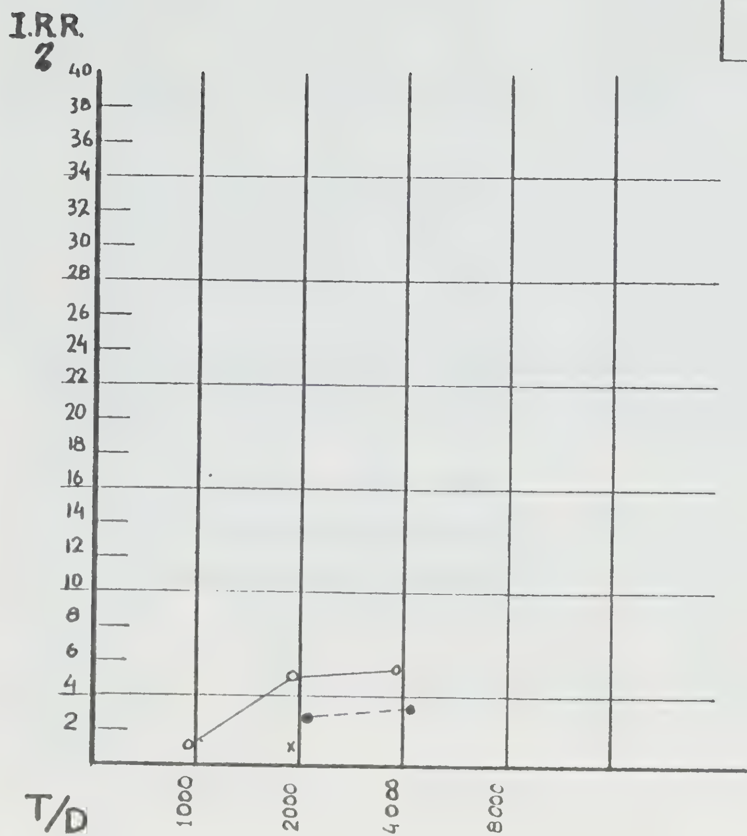


Fig. 67

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 5

METAL: Cu Zn
METHOD: — Cut & Fill
-·- Blast Hole



LEGEND:

SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %

■ □ 75 %
▲ × 50 %
● ○ 25 %

Fig. 67

MINIMUM EXPECTED VALUES OF IRR
AND ASSOCIATED PROBABILITY OF
AT LEAST BEING THAT VALUE

Table 23A

BLOCK N° 6

	CuZn		CuPbZn		NiCu		Molybdenum		Uranium		Gold		Silver		LiCb		Iron			
T/D	C.F.	B.H.	C.F.	B.H.	C.F.	B.H.	C.F.	B.H.	C.F.	B.H.	C.F.	B.H.	C.F.	B.H.	C.F.	B.H.	C.F.	B.H.	C.F.	B.H.
1000	2.9	2.0	4.3	3.0	3.4	2.8	4.0	2.6	7.5	6.6	4.7	3.8	5.4	3.4	26.5	19.8				
PROB.	0.25	0.15	0.3	0.2	0.2	0.1	0.25	0.2	0.7	0.55	0.25	0.15	0.15	0.1	0.55	0.45				
2000	4.9	4.2	6.0	4.7	4.0	4.3	4.4	4.9	9.9	8.4	5.4	4.6	8.0	7.7	28.1	18.9				
PROB.	.04	0.35	0.5	0.5	0.45	0.3	0.55	0.4	0.75	0.75	0.5	0.45	0.1	0.05	0.3	0.25				
4000	7.1	6.0	8.4	6.8	8.9	5.7	7.0	7.7	15.2	15.5	9.5	9.5	13.3	5.4	23.5	25.4				
PROB.	0.4	0.45	0.75	0.8	0.35	0.5	0.6	0.5	0.75	0.65	0.5	0.4	0.05	0.05	0.1	0.05				
8000	9.3	8.7	13.2	12.6	12.9	9.1	12.9	10.4	20.9	17.6	14.5	12.3					1.1	1.8		
PROB.	0.35	0.25	0.75	0.7	0.3	0.3	0.4	0.4	0.7	0.65	0.45	0.35					0.05	0.1		

LEGEND:
C.F. CUT & FILL
B.H. BLAST HOLE

Table 23B

OPEN PIT

BLOCK N° 6

MINIMUM EXPECTED VALUES OF IRR
AND ASSOCIATED PROBABILITY OF
AT LEAST BEING THAT VALUE

T/D \ METAL	Copper	CuZn	CuPbZn	NiCu	Mo.	Uranium	Gold	Silver	LiCb	Iron	
4000	5.0	16.0	15.6	14.8	17.6	30.5	16.1	11.8	50.2	4.1	
PROB.	0.1	0.7	0.8	0.75	0.75	0.8	0.4	0.15	0.4	0.1	
8000		24.7	24.5	23.7	29.2	51.4	23.7	28.7		5.7	
PROB.		0.75	0.85	0.75	0.75	0.8	0.55	0.05		0.4	
16000		28.1	47.7	30.5	31.4	56.5	33.0	2.1		10.4	
PROB.		0.45	0.75	0.55	0.6	0.7	0.4	0.05		0.6	
32000										13.3	
PROB.										0.85	

Fig. 6B

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

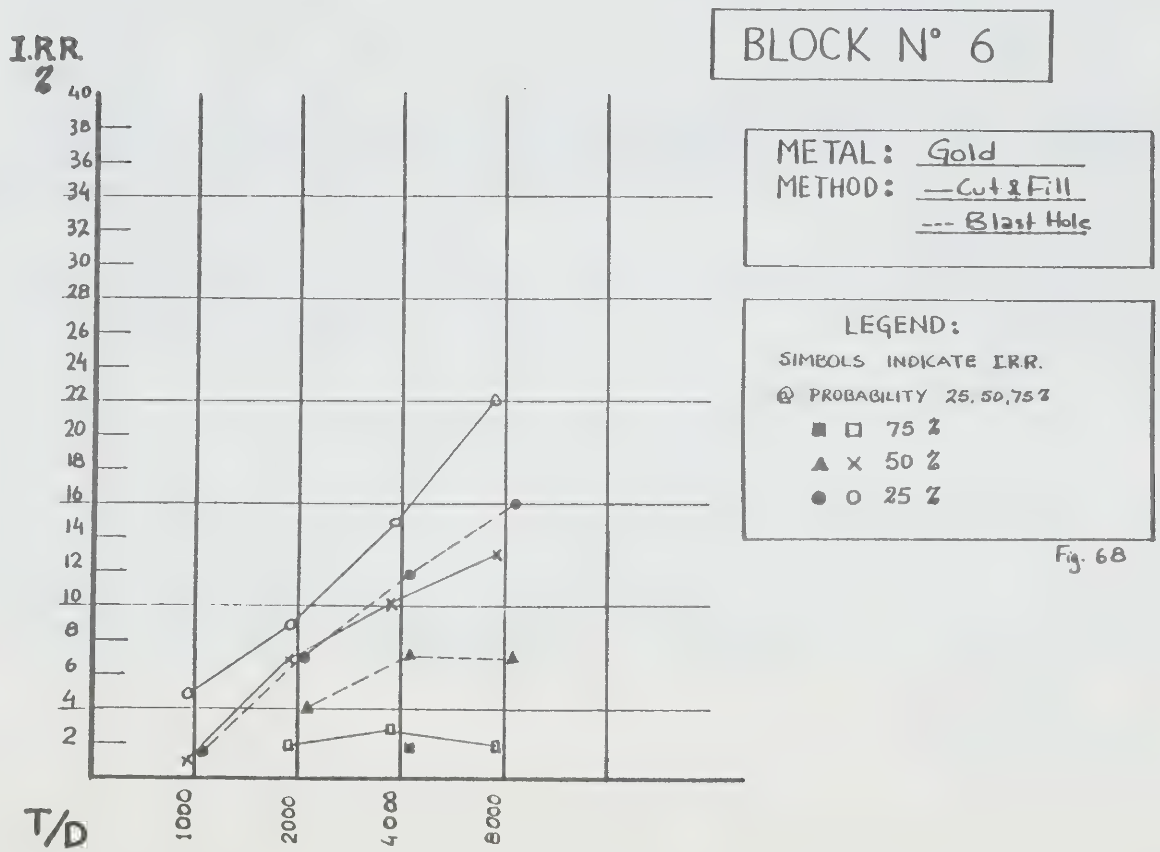


Fig. 68

Fig. 69

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 6

METAL: Uranium
METHOD: — Cut & Fill
--- Blast Hole

LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
■ □ 75 %
▲ × 50 %
● ○ 25 %

Fig. 69

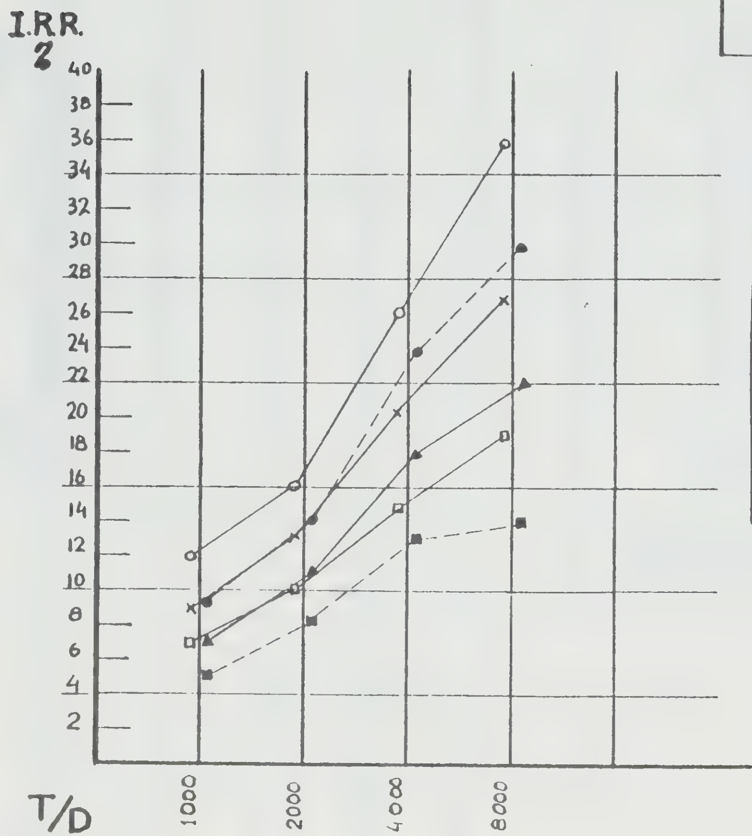


Fig. 70

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 6

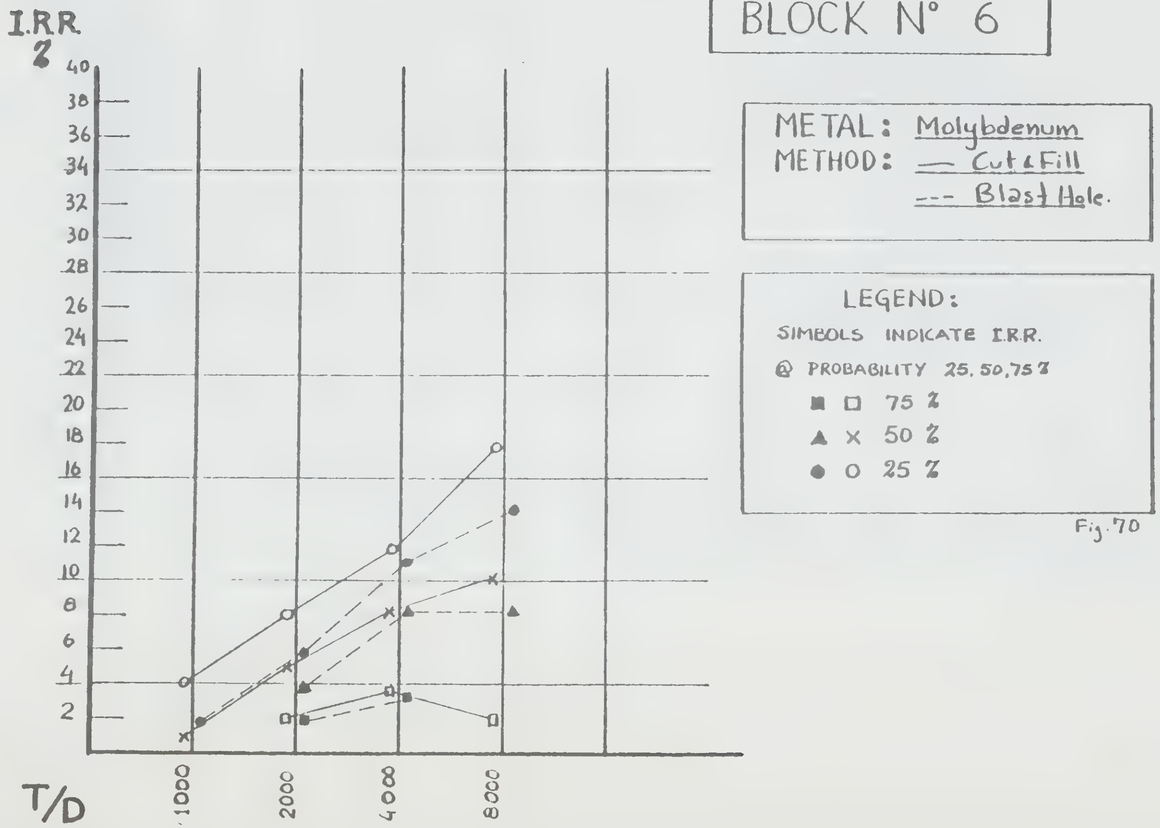


Fig. 70

Fig. 71

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 6

METAL: Ni Cu
METHOD: — Cut & Fill
--- Blast Hole

LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
■ □ 75 %
▲ × 50 %
● o 25 %

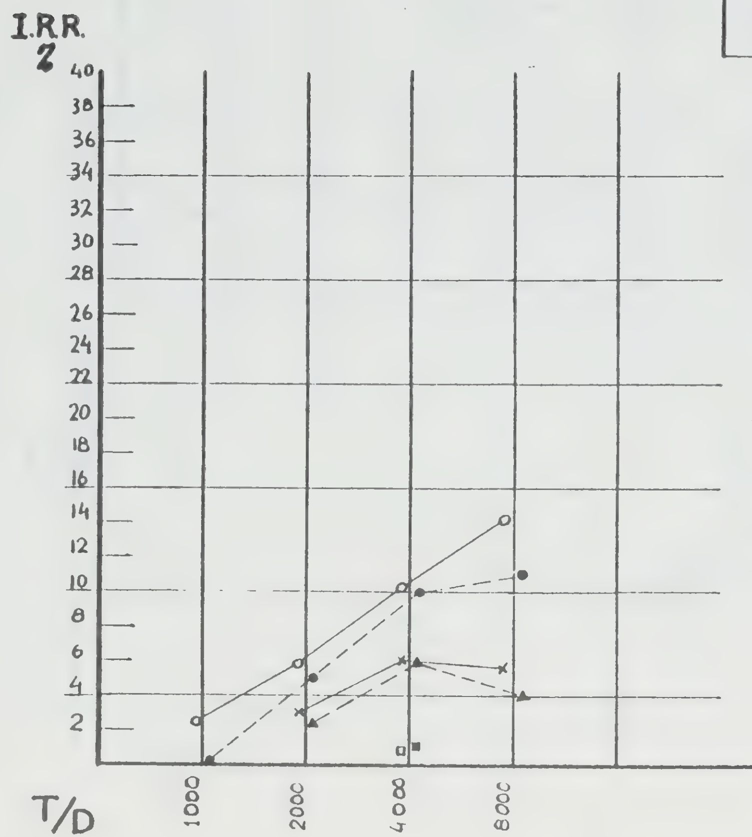
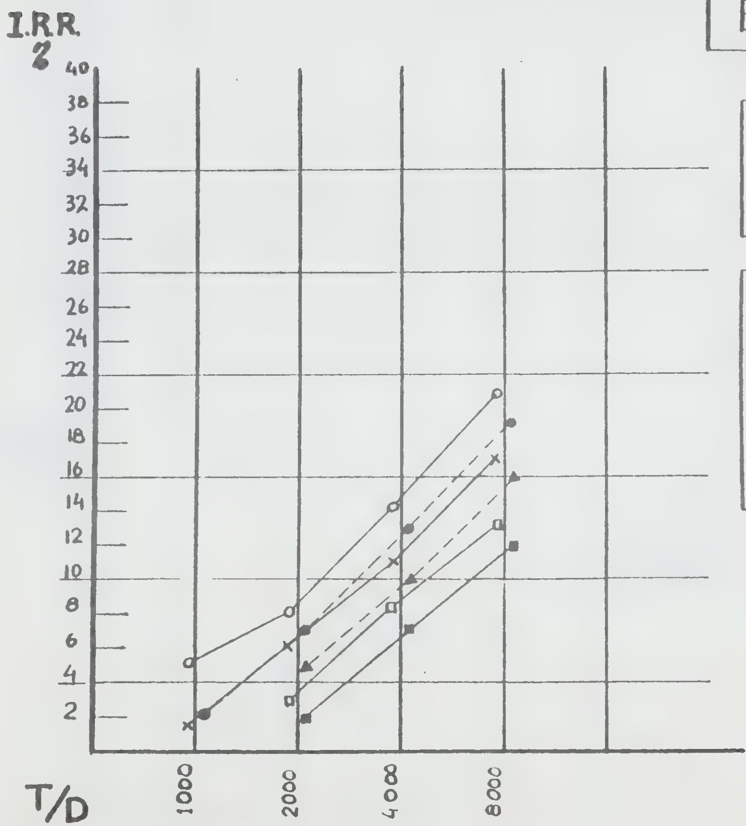


Fig. 71

Fig. 72

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 6



METAL: CuPbZn
METHOD: — Cut&Fill
--- Blast Hole

LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
■ □ 75 %
▲ × 50 %
● ○ 25 %

Fig. 72

Fig. 73

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

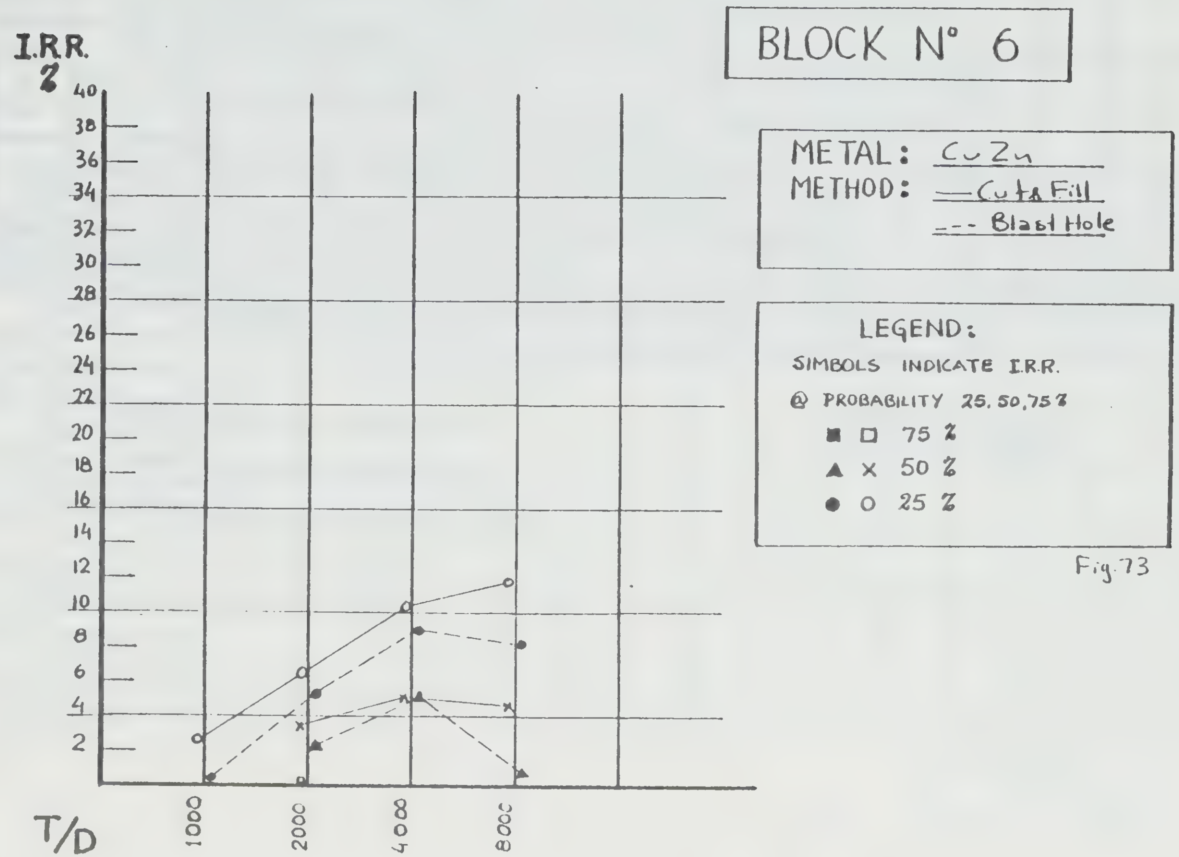


Fig. 73

MINIMUM EXPECTED VALUES OF IRR
AND ASSOCIATED PROBABILITY OF
AT LEAST BEING THAT VALUE

Table 24 A

BLOCK N°7

	CuZn		CuPbZn		NiCu		Uranium		Gold		LiCb		Platinum							
T/D	C.F.	B.H.	C.F.	B.H.	C.F.	B.H.	C.F.	B.H.	C.F.	B.H.	C.F.	B.H.	C.F.	B.H.	C.F.	B.H.	C.F.	B.H.	C.F.	B.H.
1000	.6		4.5	3.5	2.8	1.9	6.4	5.3	5.4	3.3	20.2	18.8								
PROB.	0.05		0.25	0.15	0.25	0.15	0.55	0.4	0.25	0.15	0.9	0.85								
2000			5.7	4.7	5.3	3.8	8.6	6.9	5.9	4.6	25.6	21.2	1.8	2.0						
PROB.			0.55	0.5	0.45	0.45	0.7	0.7	0.5	0.45	0.9	0.95	0.1	0.05						
4000			8.4	6.7	7.4	7.2	11.8	12.3	9.3	8.6	33.0	28.1	4.6	3.3						
PROB.			0.7	0.75	0.65	0.6	0.8	0.65	0.55	0.5	0.85	0.9	0.25	0.25						
8000			11.4	10.5	10.4	9.8	15.6	14.2	16.3	12.6	42.7	36.5	5.2	5.4						
PROB.			0.7	0.8	0.7	0.7	0.8	0.85	0.5	0.5	0.85	0.9	0.45	0.5						

LEGEND:
C.F. CUT & FILL
B.H. BLAST HOLE

Table 24B

MINIMUM EXPECTED VALUES OF IRR
AND ASSOCIATED PROBABILITY OF
AT LEAST BEING THAT VALUE

BLOCK N°7

	CHROMIUM																			
T/D	C.F.	B.H.	C.F.	B.H.	C.F.	B.H.	C.F.	B.H.	C.F.	B.H.	C.F.	B.H.	C.F.	B.H.	C.F.	B.H.	C.F.	B.H.	C.F.	B.H.
1000																				
PROB																				
2000	14.8	12.8																		
PROB.	.75	.75																		
4000	17.9	17.3																		
PROB.	.85	.8																		
8000	23.7	20.3																		
PROB.	.8	.9																		

LEGEND:
C.F. CUT & FILL
B.H. BLAST HOLE

Table 19C

OPEN PIT

BLOCK N° 7

MINIMUM EXPECTED VALUES OF IRR
AND ASSOCIATED PROBABILITY OF
AT LEAST BEING THAT VALUE

T/D \ METAL	CuZn	CuPbZn	NiCu	Uranium	Gold	LiCb	Platinum	Chromium			
4000	4.6	16.9	14.2	20.6	13.4	46.2	5.4				
PROB.	0.05	0.85	0.85	0.9	0.45	0.9	0.1				
8000		17.4	18.1	25.2	25.2	58.1	5.7				
PROB.		0.9	0.8	0.85	0.5	0.95	0.45				
16000		27.4	20.2	40.8	31.3	130.4	9.9				
PROB.		0.8	0.8	0.8	0.55	0.85	0.45				
32000											
PROB.											

Fig. 74

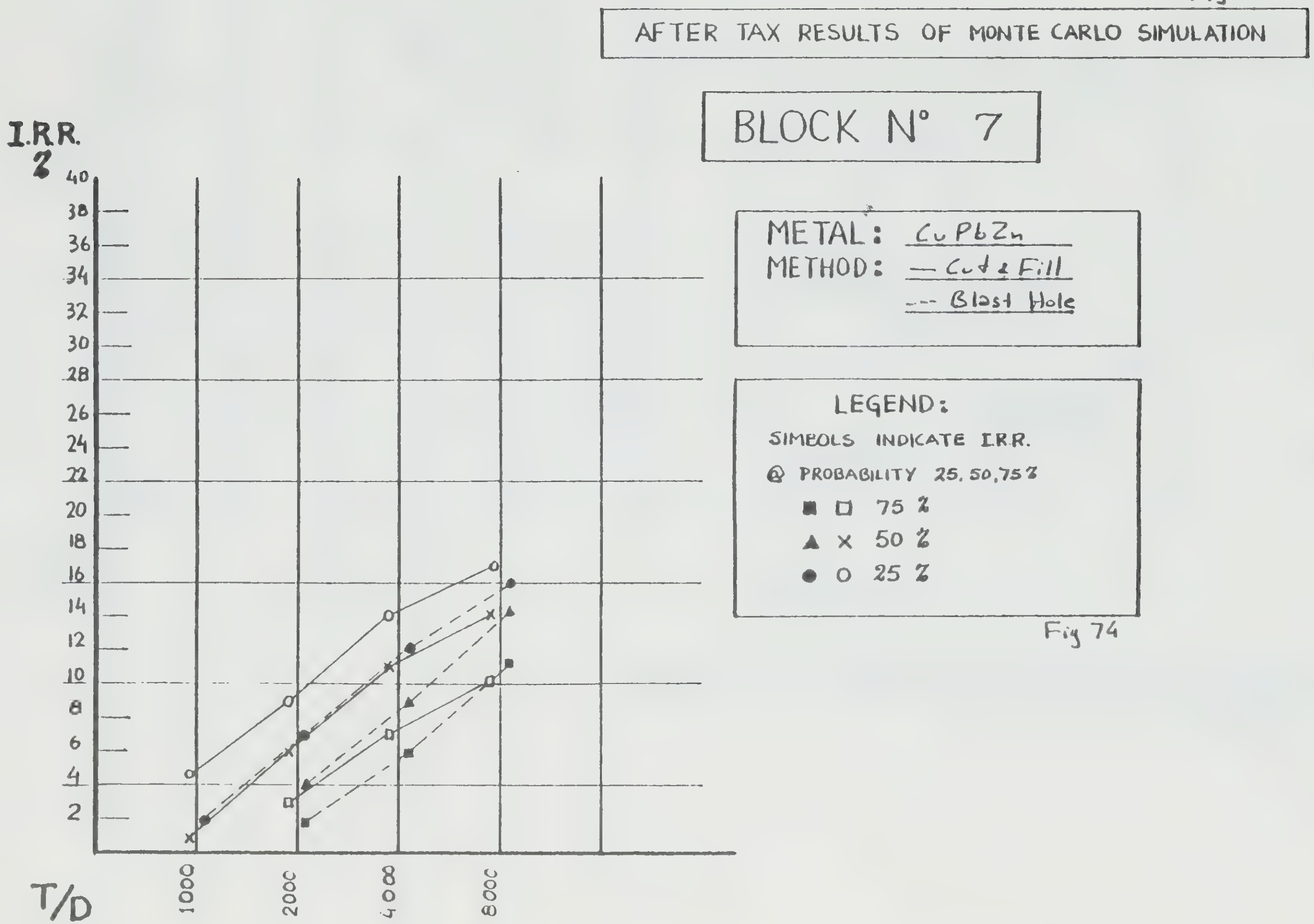

AFTER TAX RESULTS OF MONTE CARLO SIMULATION
BLOCK N° 7
METAL: CuPbZn
METHOD: — Cut & Fill
--- Blast Hole
LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
■ □ 75 %
▲ × 50 %
● ○ 25 %
Fig 74
I.R.R. %
40
38
36
34
32
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
T/D
1000
2000
4000
8000

Fig. 75

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 7

METAL: NiCu
METHOD: — Cut & Fill
--- Blast Hole

LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
■ □ 75 %
▲ × 50 %
● ○ 25 %

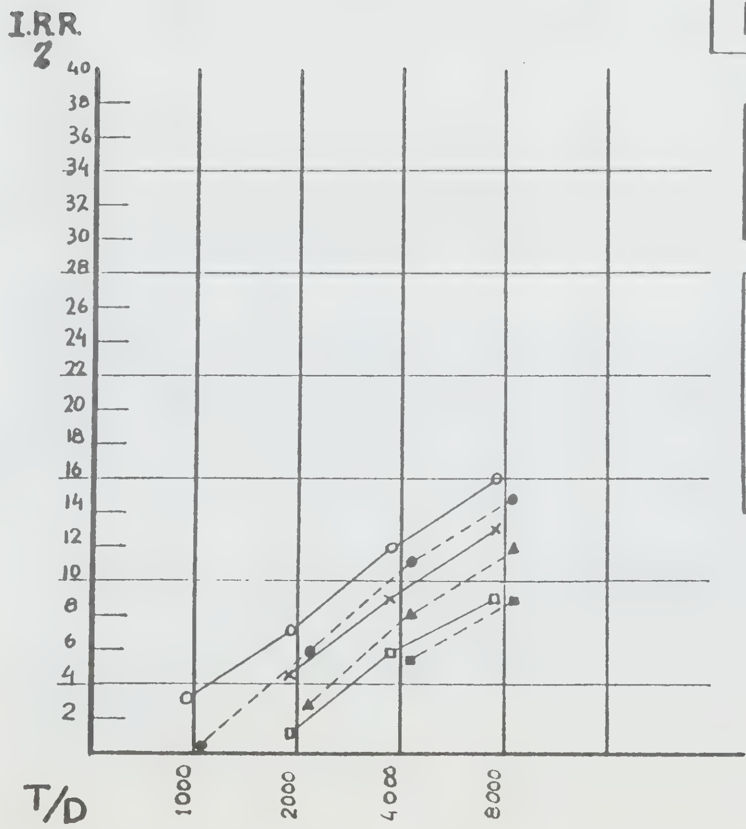
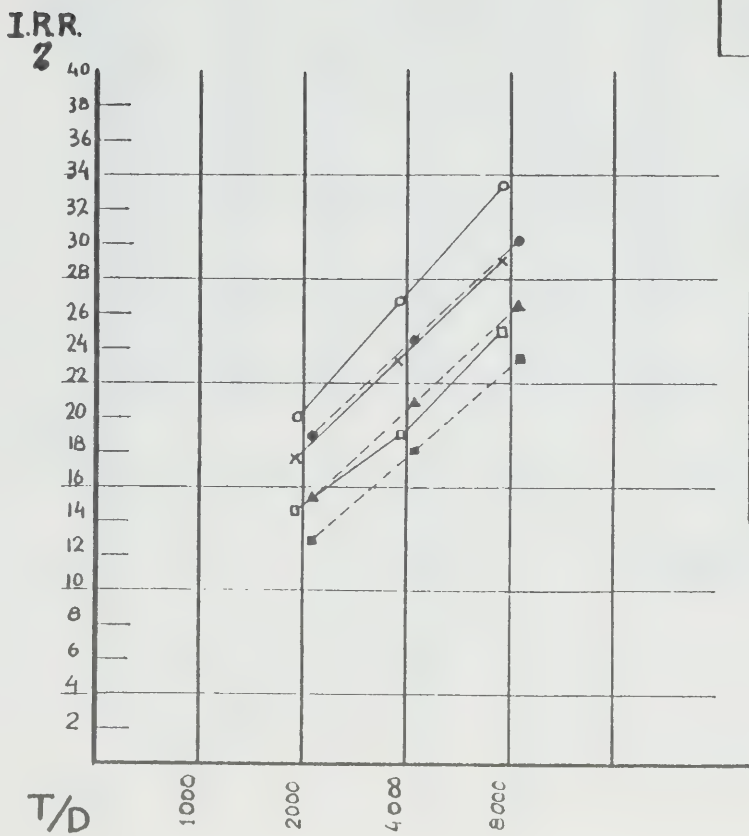


Fig. 75

Fig. 76

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 7



METAL: Chromium
METHOD: — Cut & Fill
--- Blast Hole

LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
■ □ 75 %
▲ × 50 %
● o 25 %

Fig. 76

Fig. 77

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

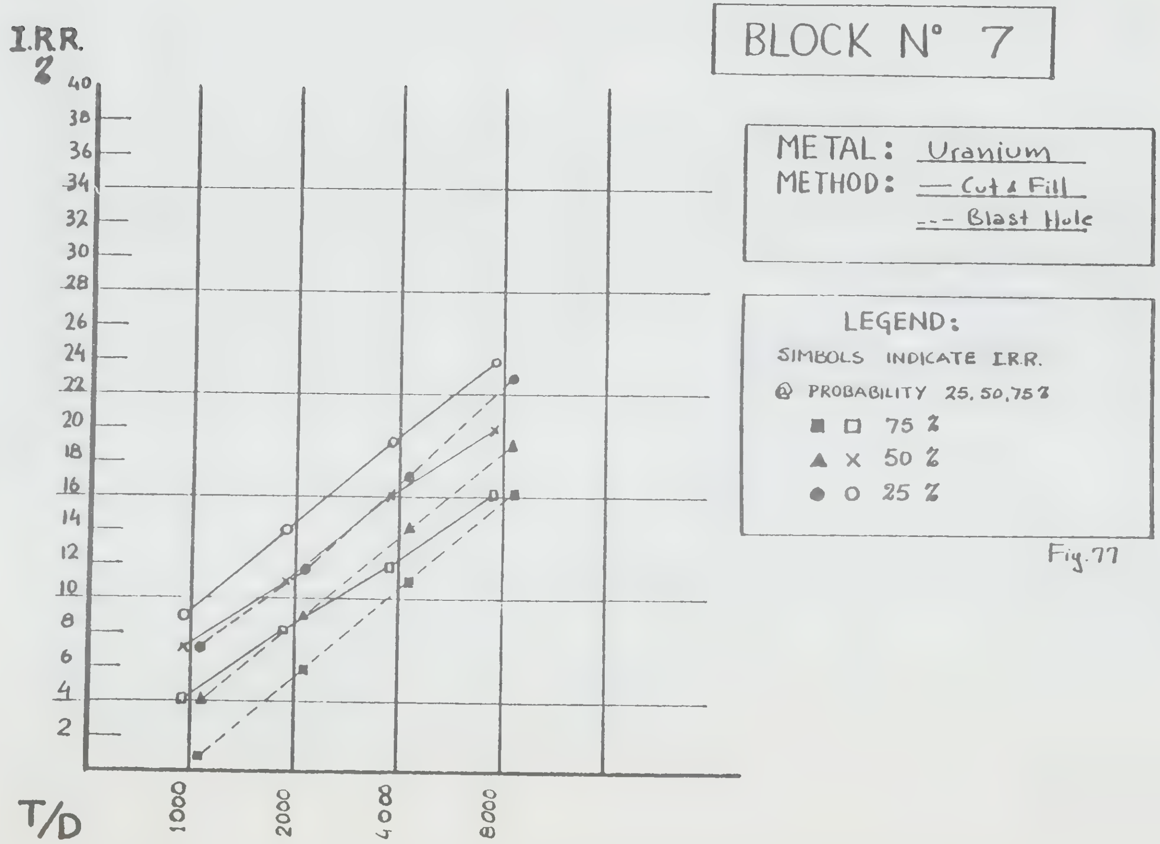


Fig. 77

Fig 78

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 7

METAL: Gold
METHOD: — Cut & Fill
--- Blast Hole

LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
■ □ 75 %
▲ × 50 %
● o 25 %

Fig. 78

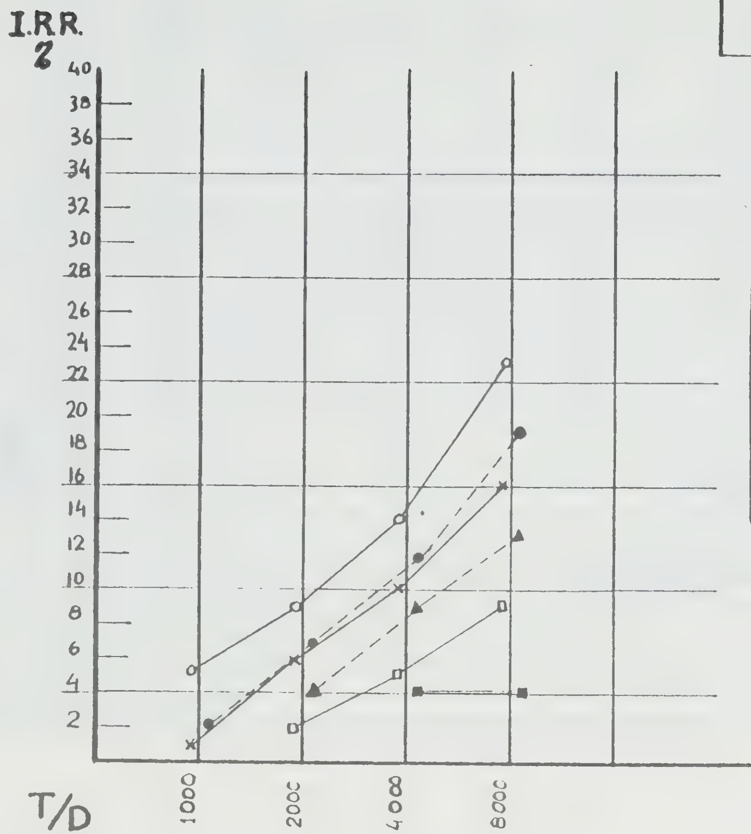


Fig. 79

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 7

METAL: Platinum
METHOD: — Cut & Fill
--- Blast Hole

LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
■ □ 75 %
▲ × 50 %
● ○ 25 %

Fig. 79

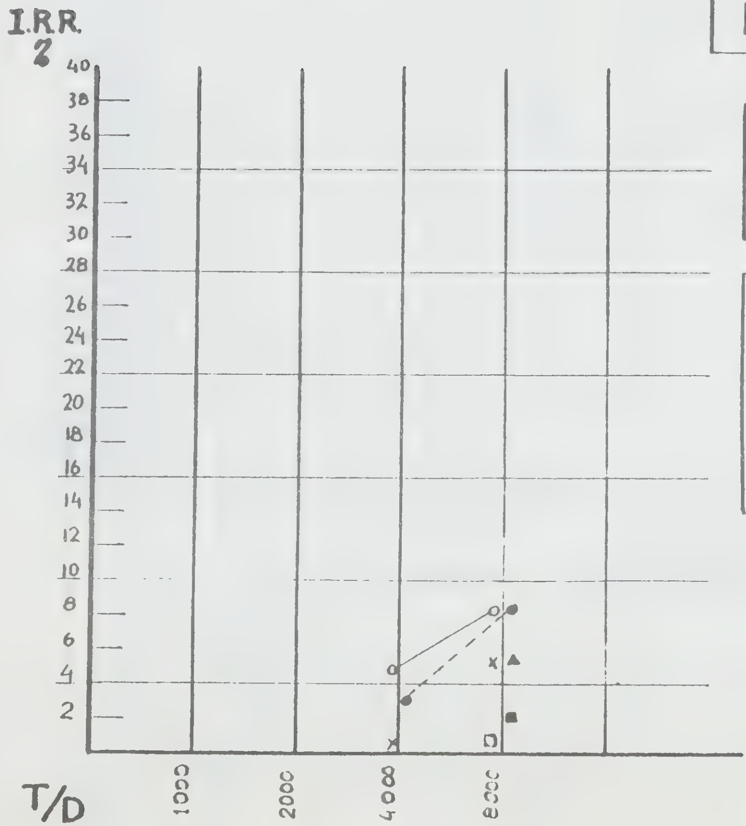


Table 25A

MINIMUM EXPECTED VALUES OF IRR
AND ASSOCIATED PROBABILITY OF
AT LEAST BEING THAT VALUE

BLOCK N°8

	CuPbZn		Gold																	
T/D	C.F.	B.H.	C.F.	B.H.	C.F.	B.H.	C.F.	B.H.	C.F.	B.H.	C.F.	B.H.	C.F.	B.H.	C.F.	B.H.	C.F.	B.H.	C.F.	B.H.
1000	7.9	5.4	3.3	4.3																
PROB.	0.7	0.7	0.25	0.1																
2000	11.8	9.9	7.2	6.3																
PROB.	0.75	0.75	0.15	0.1																
4000	15.4	16.5	10.4	6.6																
PROB.	0.8	0.7	0.1	0.1																
8000	23.4	21.0	6.2	2.5																
PROB.	0.8	0.7	0.05	0.05																

LEGEND:
C.F. CUT & FILL
B.H. BLAST HOLE

Table 25B

OPEN PIT

BLOCK N° 8

MINIMUM EXPECTED VALUES OF IRR
AND ASSOCIATED PROBABILITY OF
AT LEAST BEING THAT VALUE

T/D \ METAL	CuPbZn	Gold
4000	27.8	12.5
PROB.	0.85	0.2
8000	49.6	15.9
PROB.	0.85	0.15
16000	69.8	10.9
PROB.	0.8	0.05
32000		
PROB.		

Fig. 80

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 8

METAL: CuPbZn
METHOD: — Cut & Fill
--- Blast Hole

LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
■ □ 75 %
▲ × 50 %
● ○ 25 %

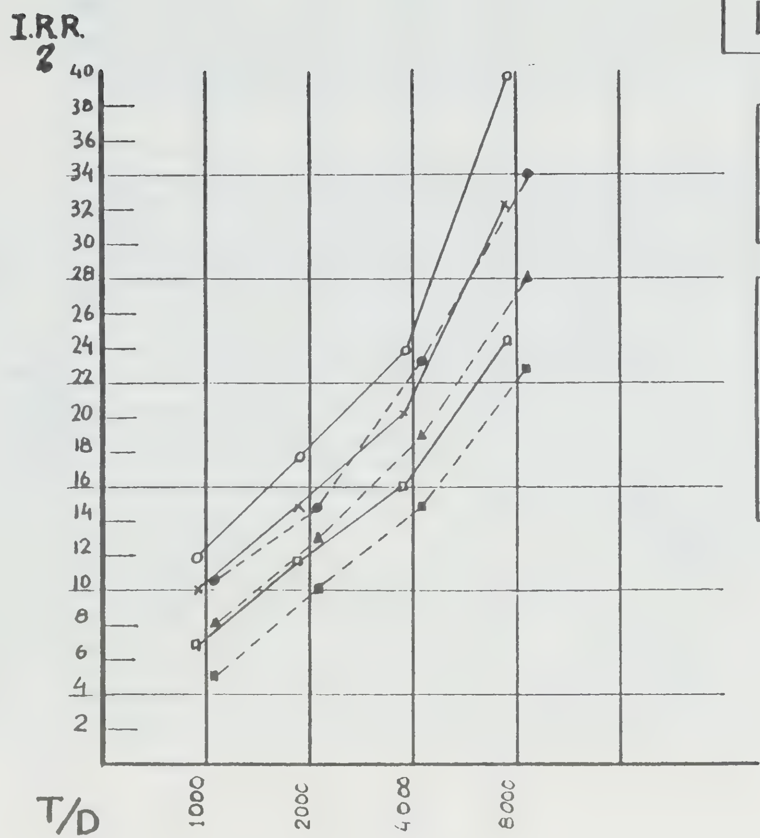


Fig. 80

Fig. 81

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 8

METAL: Gold
METHOD: — Cut & Fill
--- Blast Hole

LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
■ □ 75 %
▲ × 50 %
● o 25 %

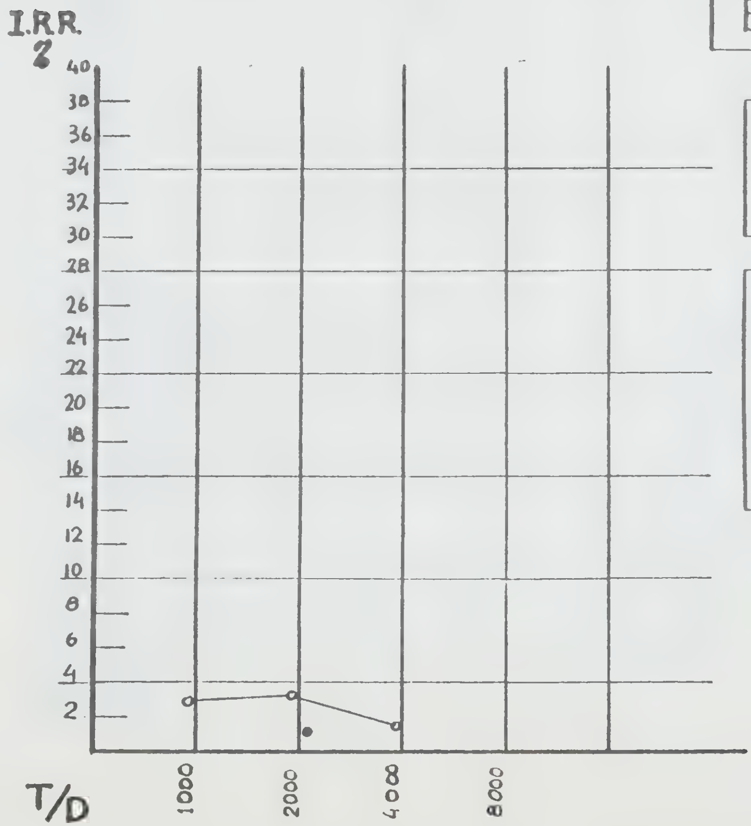


Fig. 81

MINIMUM EXPECTED VALUES OR IRR
AND ASSOCIATED PROBABILITY OF
AT LEAST BEING THAT VALUE

Table 26A

BLOCK Nº9

	CuPbZn		Uranium		Gold		Silver		LiCb											
T/D	C.F.	B.H	C.F.	B.H	C.F.	B.H.	C.F.	B.H	C.F.	B.H.	C.F.	B.H.	C.F.	B.H.	C.F.	B.H.	C.F.	B.H.	C.F.	B.H.
1000	10.0	7.9	5.8	4.4	5.3	3.6	4.9	4.6	20.2	19.9										
PROB	0.7	0.7	0.65	0.5	0.2	0.15	0.25	0.15	0.9	0.8										
2000	13.3	12.0	8.0	7.0	7.8	6.4	7.5	5.8	25.3	21.3										
PROB.	0.8	0.75	0.75	0.7	0.2	0.15	0.2	0.15	0.9	0.95										
4000	144	15.5	12.8	12.6	7.4	6.7	10.8	6.4	31.0	28.8										
PROB.	0.95	0.85	0.7	0.65	0.25	0.2	0.15	0.15	0.9	0.9										
8000	24.9	22.6	18.1	17.2	15.5	10.3	16.5	4.2	51.2	47.3										
PROB.	0.8	0.8	0.75	0.7	0.05	0.05	0.05	0.05	0.85	0.8										

LEGEND:
C.F. CUT & FILL
B.H. BLAST HOLE

Table 26B

OPEN PIT

BLOCK N° 9

MINIMUM EXPECTED VALUES OF IRR
AND ASSOCIATED PROBABILITY OF
AT LEAST BEING THAT VALUE

METAL / T/D	CuPbZn	Uranium	Gold	Silver	LiCb						
4000	28.4	21.5	18.3	11.6	46.2						
PROB.	0.85	0.85	0.2	0.25	0.9						
8000	39.3	31.0	25.1	30.1	73.2						
PROB.	0.85	0.8	0.15	0.1	0.9						
16000	87.6	54.1	16.6	12.2	193.6						
PROB.	0.8	0.85	0.1	0.05	0.8						
32000											
PROB.											

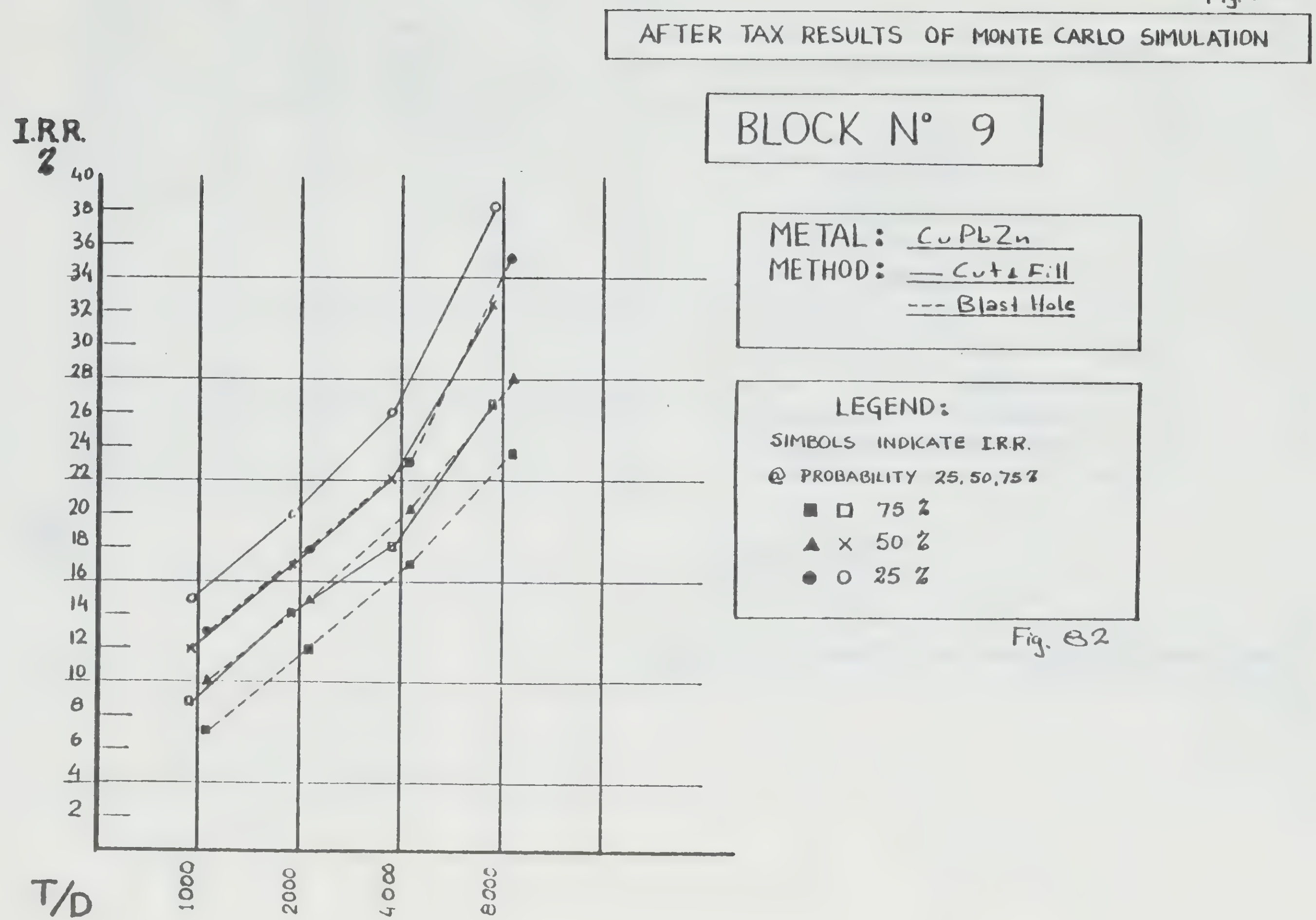

AFTER TAX RESULTS OF MONTE CARLO SIMULATION
BLOCK N° 9
METAL: CuPbZn
METHOD: — Cut & Fill
--- Blast Hole
LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
■ □ 75 %
▲ × 50 %
● ○ 25 %
I.R.R. %
40
38
36
34
32
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
T/D
1000
2000
4000
8000

Fig. 82

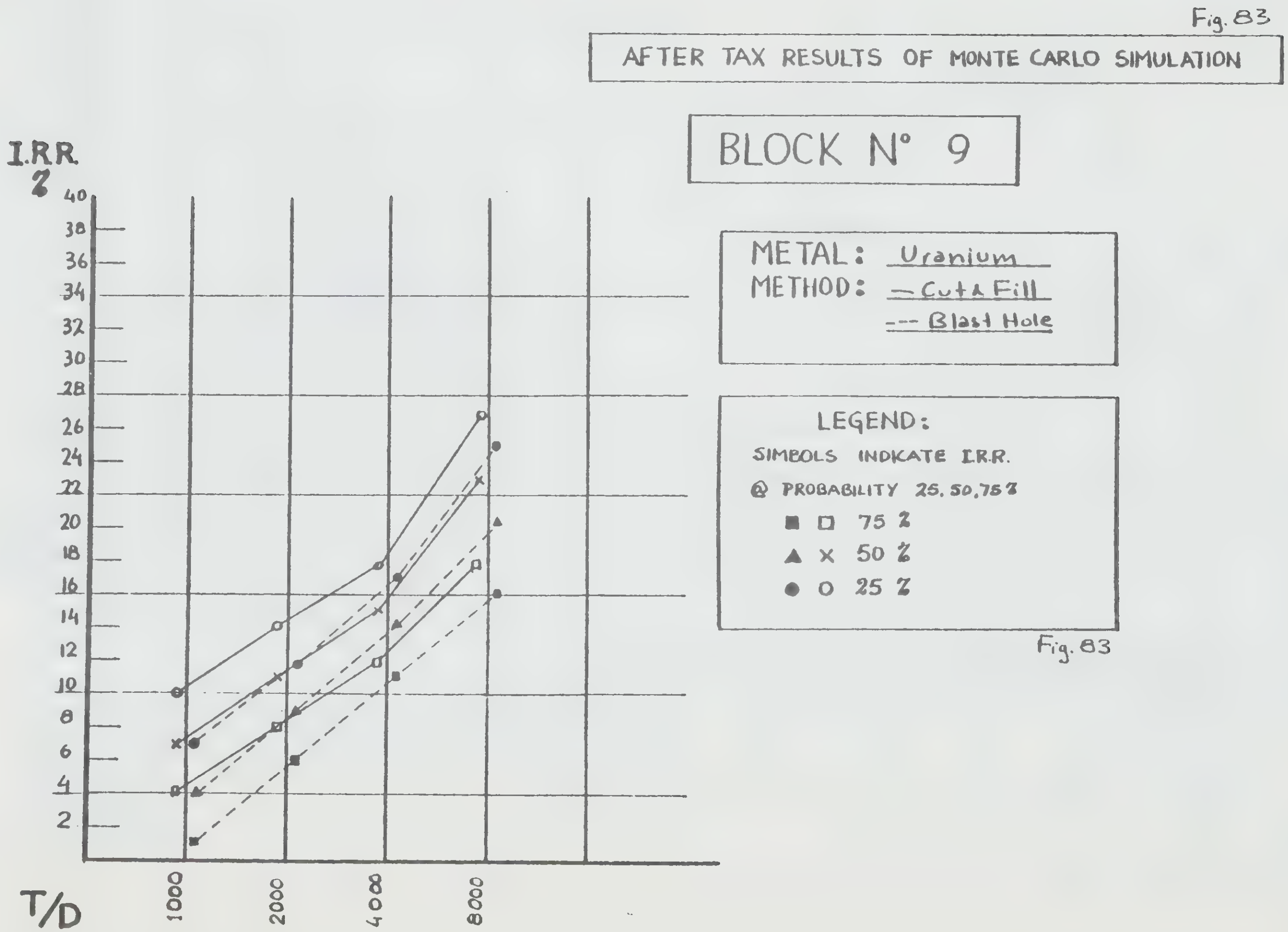


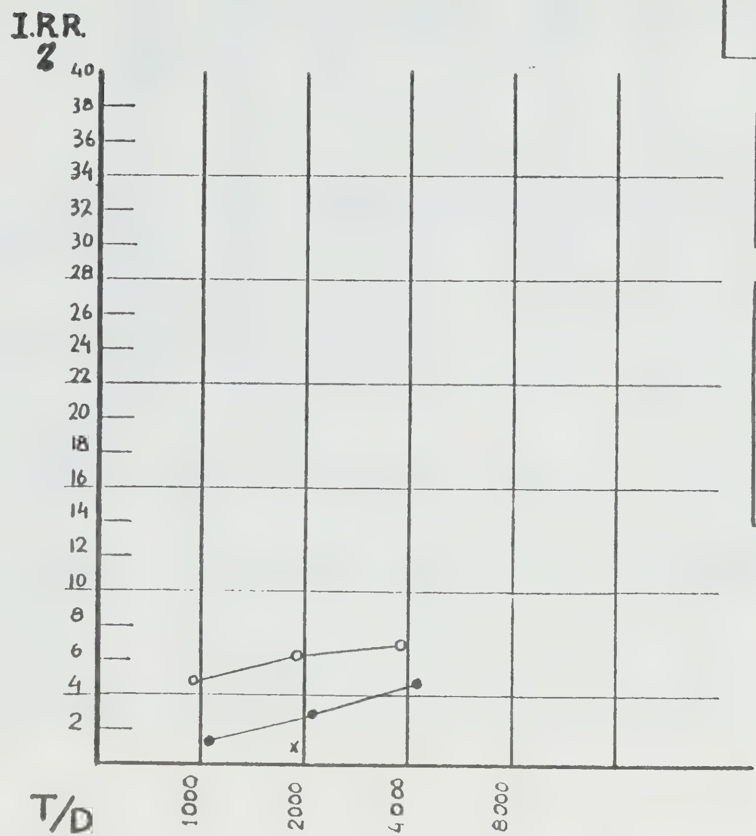
Fig. 83
AFTER TAX RESULTS OF MONTE CARLO SIMULATION
BLOCK N° 9
METAL: Uranium
METHOD: — Cut & Fill
--- Blast Hole
LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
75 %
50 %
25 %
Fig. 83
I.R.R. %
40
38
36
34
32
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
T/D
1000
2000
4008
8000

Fig. 84

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 9

METAL: Gold
METHOD: — Cut & Fill
--- Blast Hole



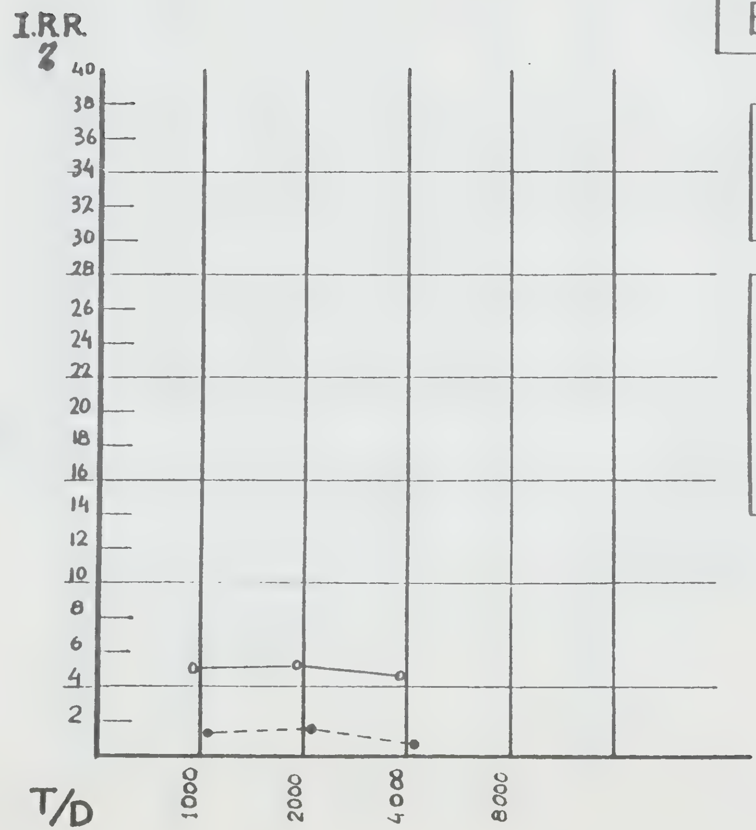
LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
■ □ 75 %
▲ × 50 %
● ○ 25 %

Fig. 84

Fig. 85

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 9



METAL: Silver
METHOD: — Cut & Fill
--- Blast Hole

LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
■ □ 75 %
▲ × 50 %
● ○ 25 %

Fig. 85

MINIMUM EXPECTED VALUES OF IRR

AND ASSOCIATED PROBABILITY OF

AT LEAST BEING THAT VALUE

Table 27 A

BLOCK N° 10

	Copper		CuPbZn		Uranium		PbZn													
T/D	C.F.	B.H.	C.F.	B.H.	C.F.	B.H.	C.F.	B.H.	C.F.	B.H.	C.F.	B.H.	C.F.	B.H.	C.F.	B.H.	C.F.	B.H.	C.F.	B.H.
1000	8.1	6.0	10.7	10.1	9.8	7.9														
PROB.	0.25	0.15	0.75	0.6	0.7	0.65														
2000	8.8	7.0	16.0	12.9	12.8	10.8														
PROB.	0.15	0.1	0.7	0.65	0.8	0.8														
4000	4.1		21.3	15.6	15.6	16.1		.2												
PROB.	0.05		0.5	0.5	0.9	0.8		0.05												
8000			16.2	18.4	21.0	19.9	2.4	2.5												
PROB.			0.3	0.15	0.8	0.85	0.1	0.15												

LEGEND:
C.F. CUT & FILL
B.H. BLAST HOLE

Table 27B

OPEN PIT

BLOCK N° 10

MINIMUM EXPECTED VALUES OF IRR
AND ASSOCIATED PROBABILITY OF
AT LEAST BEING THAT VALUE

METAL / T/D	Copper	CuPbZn	PbZn	Uranium							
4000	18.5	42.9	3.6	21.5							
PROB.	0.25	0.8	0.2	0.9							
8000	18.0	47.3	4.1	26.0							
PROB.	0.05	0.6	0.55	0.95							
16000		45.1	6.7	59.4							
PROB.		0.35	0.65	0.85							
32000											
PROB.											

Fig. 86

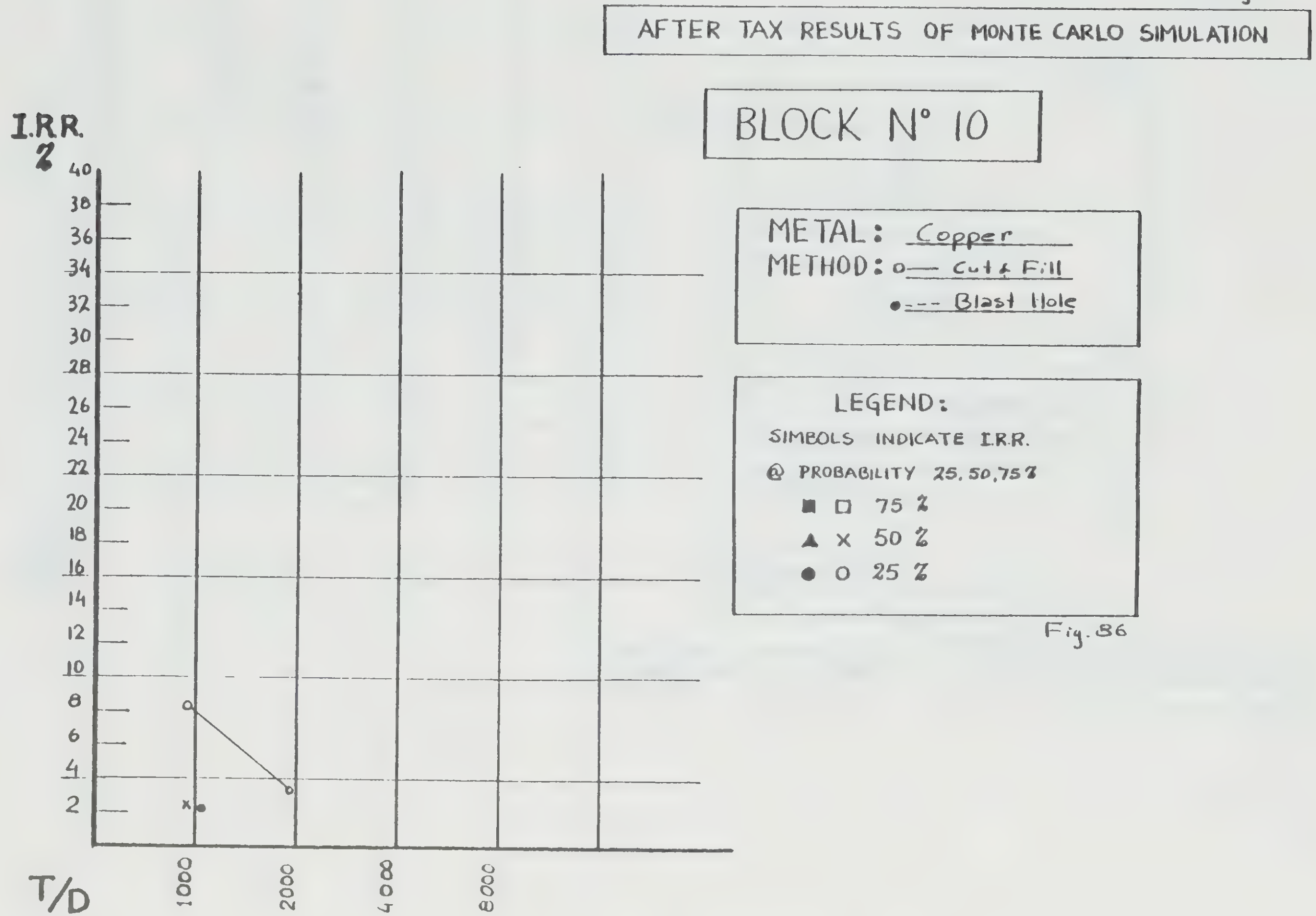

AFTER TAX RESULTS OF MONTE CARLO SIMULATION
BLOCK N° 10
METAL: Copper
METHOD: o— Cut & Fill
●--- Blast Hole
LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
■ □ 75 %
▲ x 50 %
● o 25 %
I.R.R. %
40
38
36
34
32
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
T/D
1000
2000
4000
8000

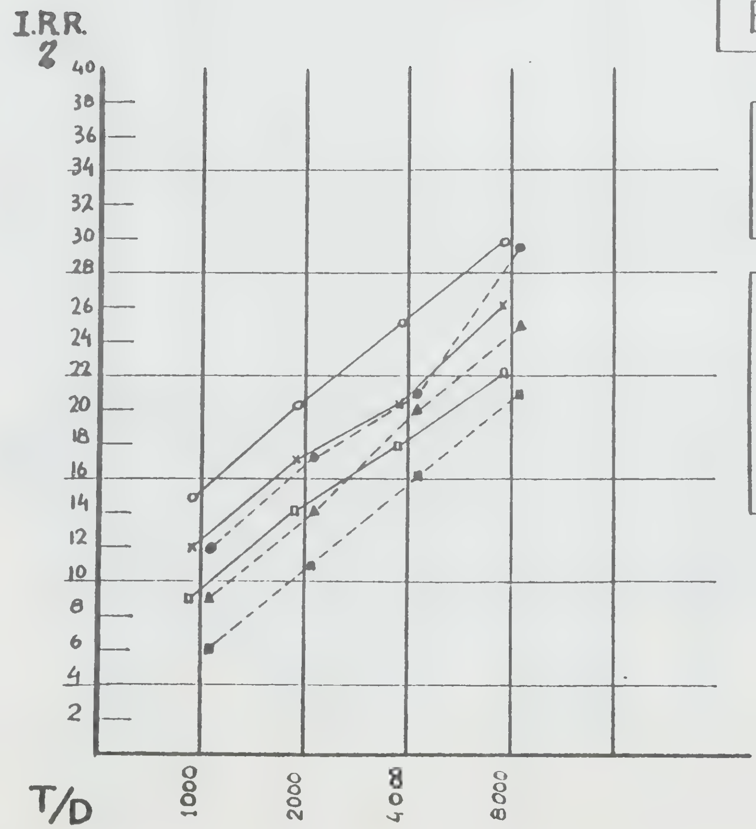
Fig. 86

Fig. 87

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 10

METAL: Uranium
METHOD: — Cut & Fill
--- Blast Hole



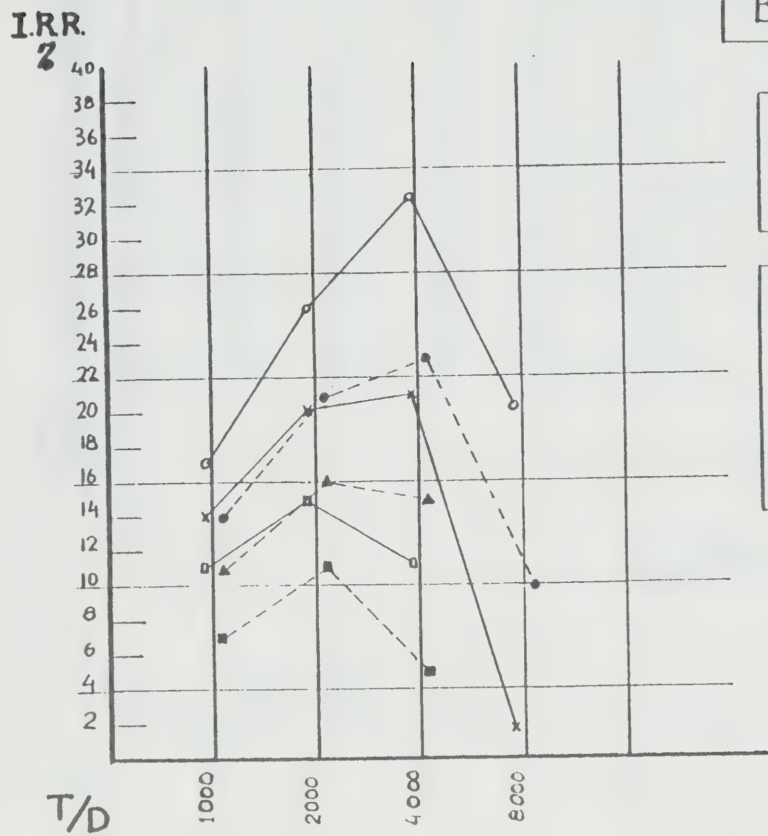
LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
■ □ 75 %
▲ × 50 %
● ○ 25 %

Fig. 87

Fig. 88

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 10



METAL: CuPbZn
METHOD: o — Cut & Fill
● ---- Blast Hole

LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
■ □ 75 %
▲ × 50 %
● o 25 %

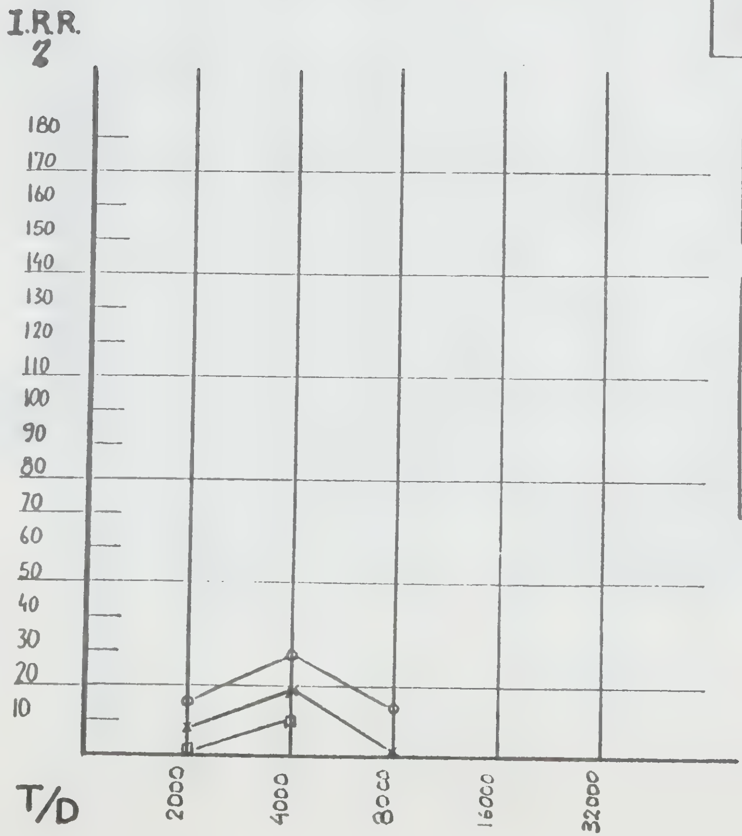
Fig. 88

Fig 89

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 1

METAL: Copper
METHOD: OPEN PIT



LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
□ 75 %
x 50 %
o 25 %

Fig. 89

Fig 90

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 1

METAL: Cu Zn
METHOD: OPEN PIT

LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
□ 75 %
× 50 %
○ 25 %

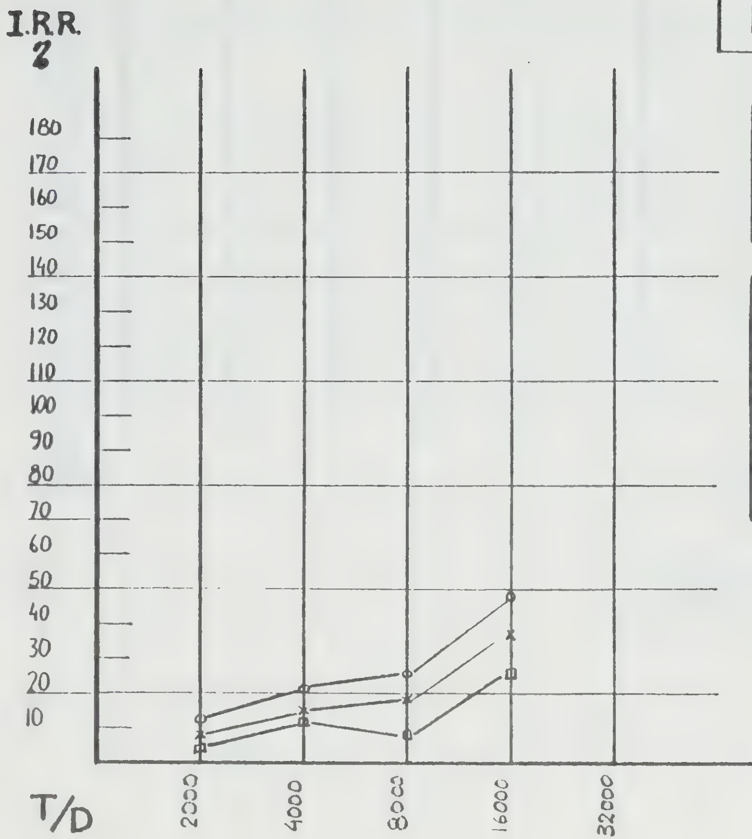


Fig. 90

Fig 91

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 1

METAL: Cu Pb Zn
METHOD: OPEN PIT

LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
□ 75 %
x 50 %
o 25 %

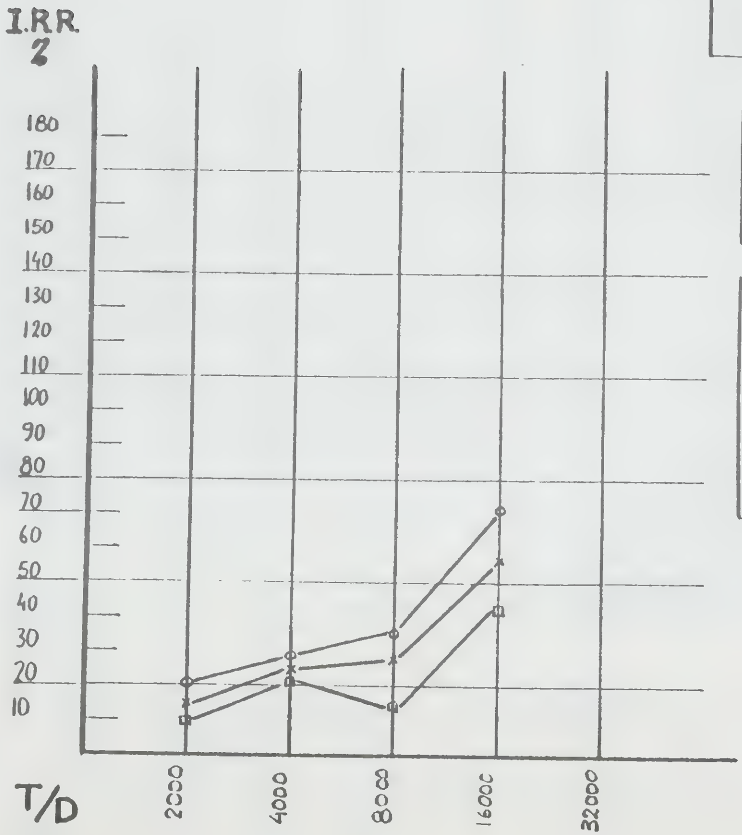


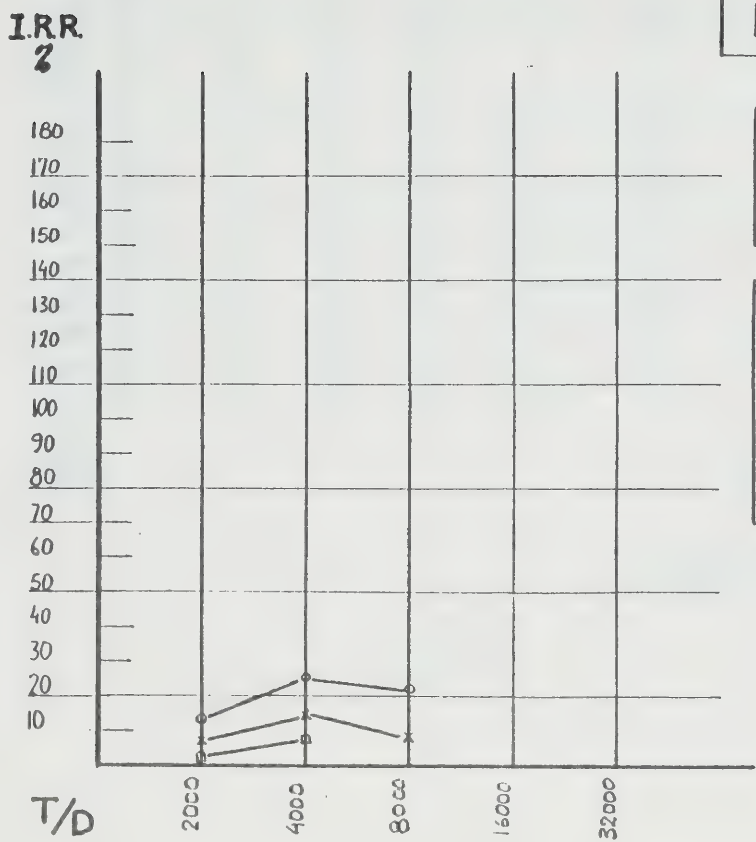
Fig. 91

Fig 92

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 1

METAL: Ni Cu
METHOD: OPEN PIT



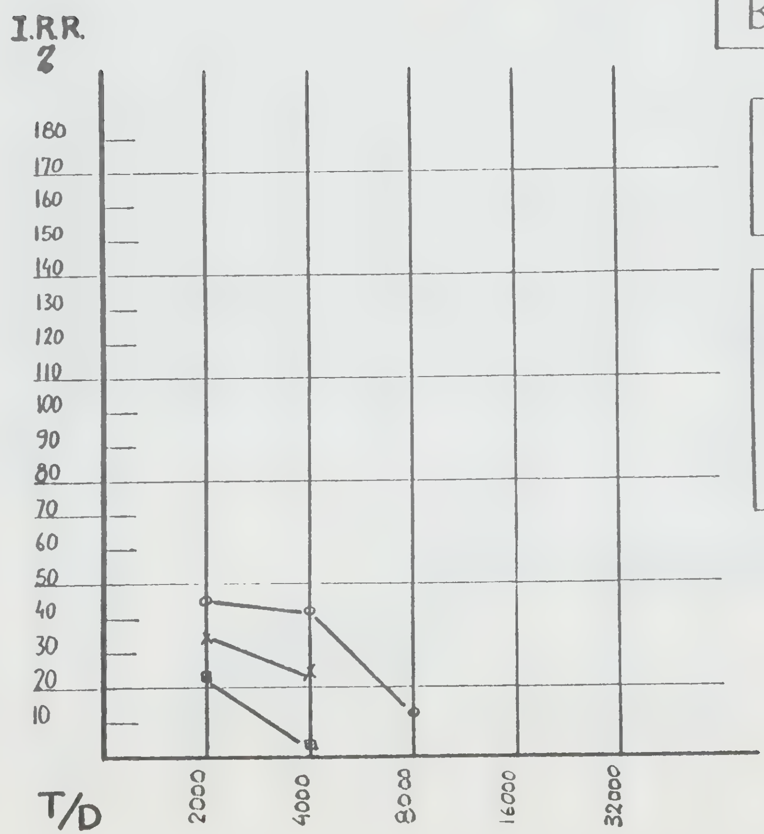
LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
□ 75 %
× 50 %
o 25 %

Fig. 92

Fig 93

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 1



METAL: Molybdenum
METHOD: OPEN PIT

LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
□ 75 %
× 50 %
○ 25 %

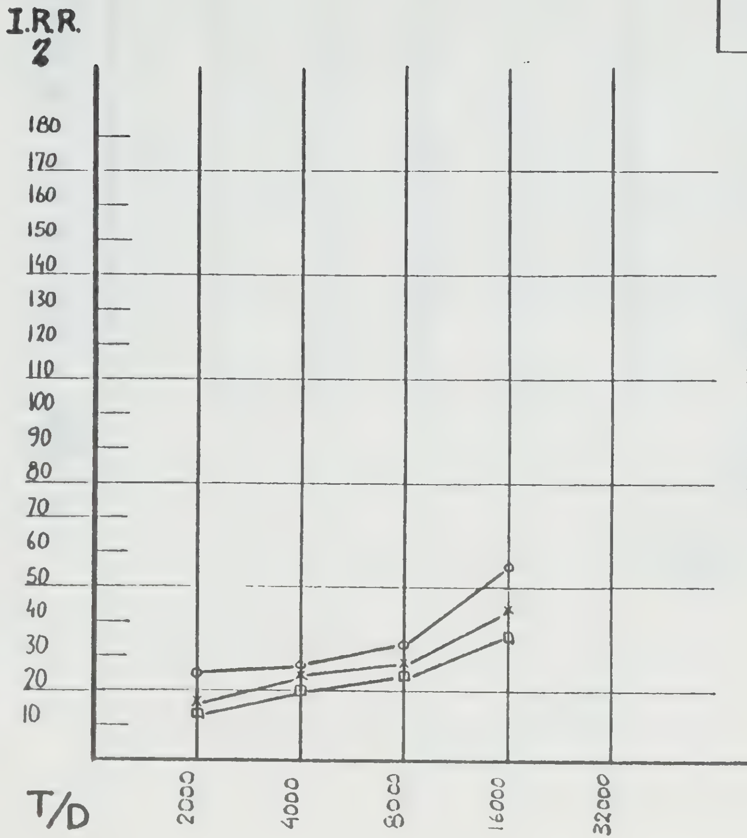
Fig. 93

Fig 94

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 1

METAL: Uranium
METHOD: OPEN PIT



LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
□ 75 %
× 50 %
o 25 %

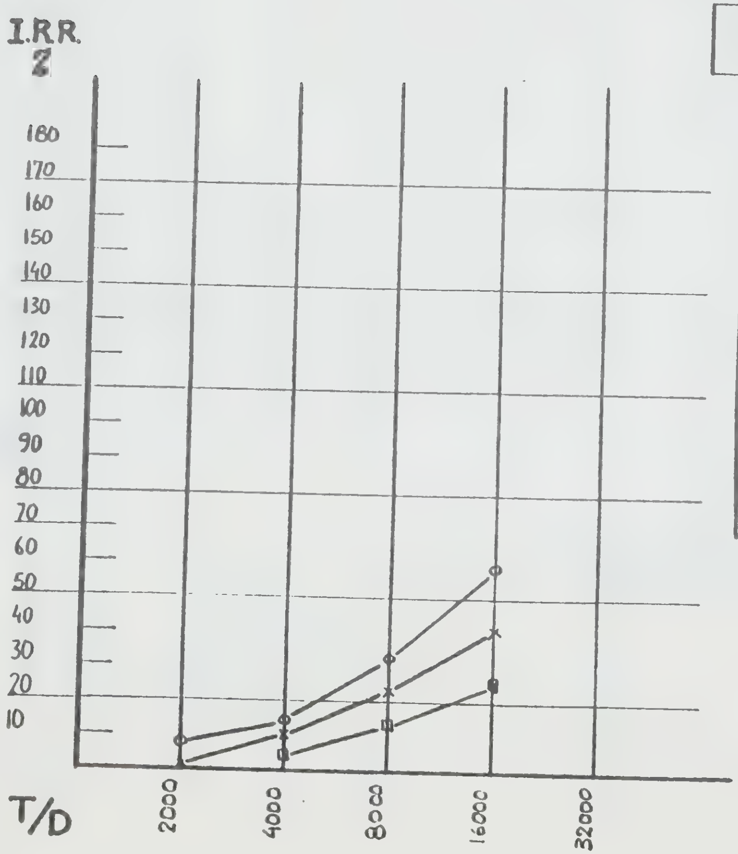
Fig. 94

Fig 95

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 1

METAL: Gold
METHOD: OPEN PIT



LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
□ 75 %
× 50 %
o 25 %

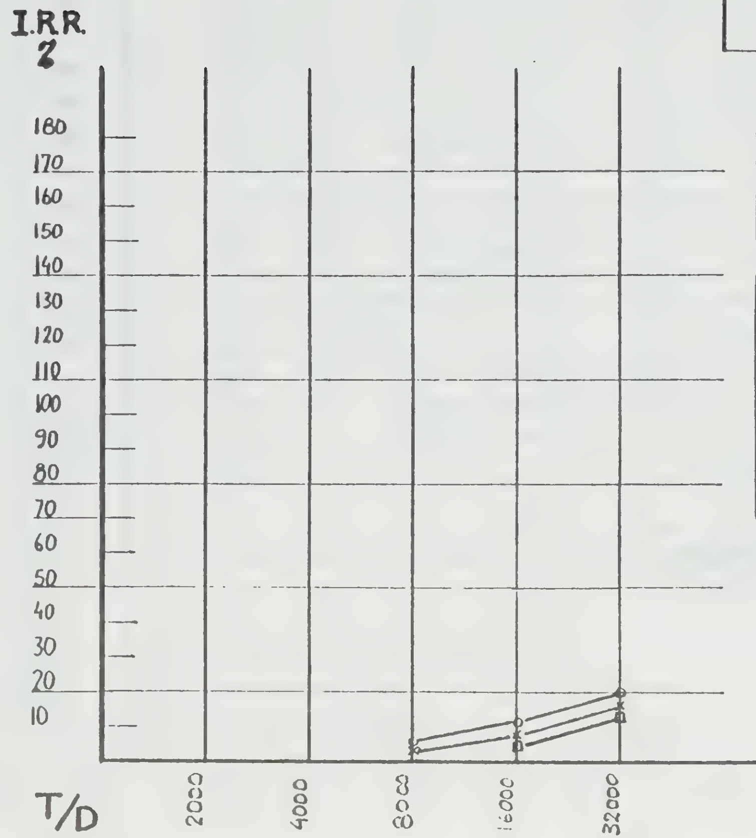
Fig. 95

Fig 96

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 1

METAL: Iron
METHOD: OPEN PIT



LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
□ 75 %
× 50 %
o 25 %

Fig 96

Fig 97

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 1

METAL: Li Cb
METHOD: OPEN PIT

LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
□ 75 %
x 50 %
o 25 %

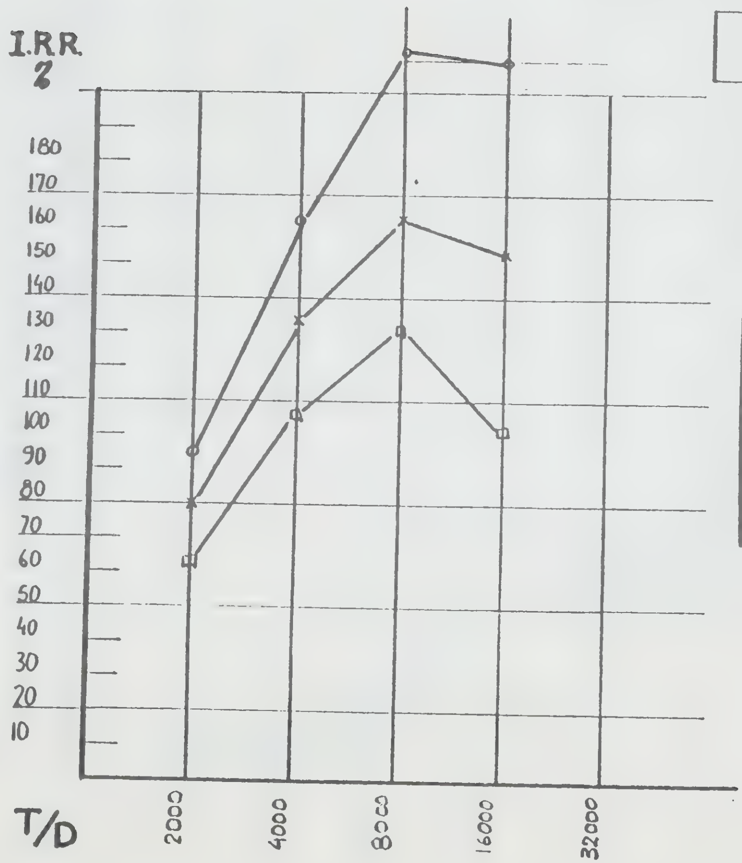


Fig. 97

Fig 98

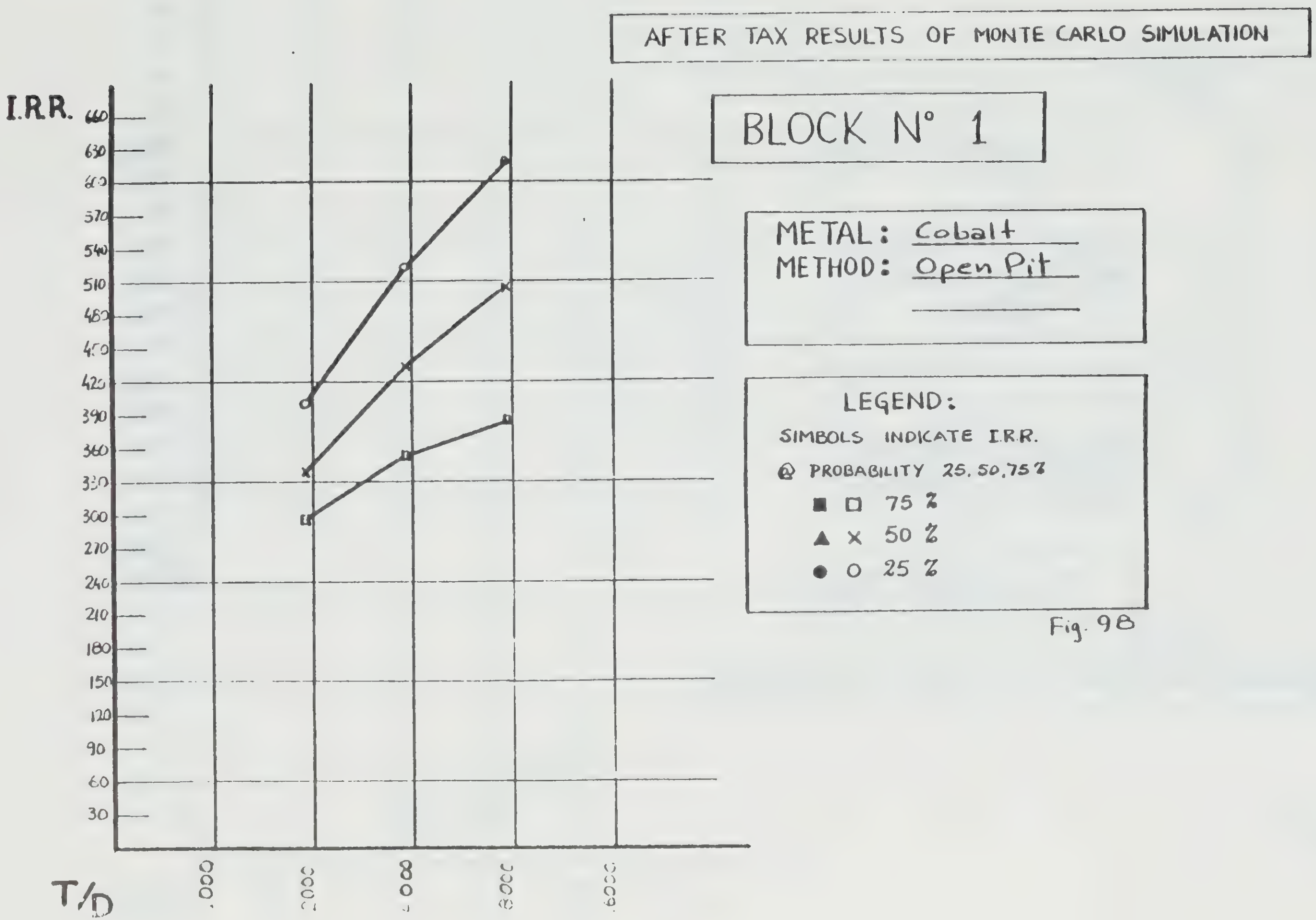

AFTER TAX RESULTS OF MONTE CARLO SIMULATION
BLOCK N° 1
METAL: Cobalt
METHOD: Open Pit
LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
■ □ 75 %
▲ × 50 %
● o 25 %
I.R.R.
660
630
600
570
540
510
480
450
420
390
360
330
300
270
240
210
180
150
120
90
60
30
T/D

Fig. 98

Fig. 99

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 2

METAL: Copper
METHOD: OPEN PIT

LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
□ 75 %
× 50 %
o 25 %

Fig. 99

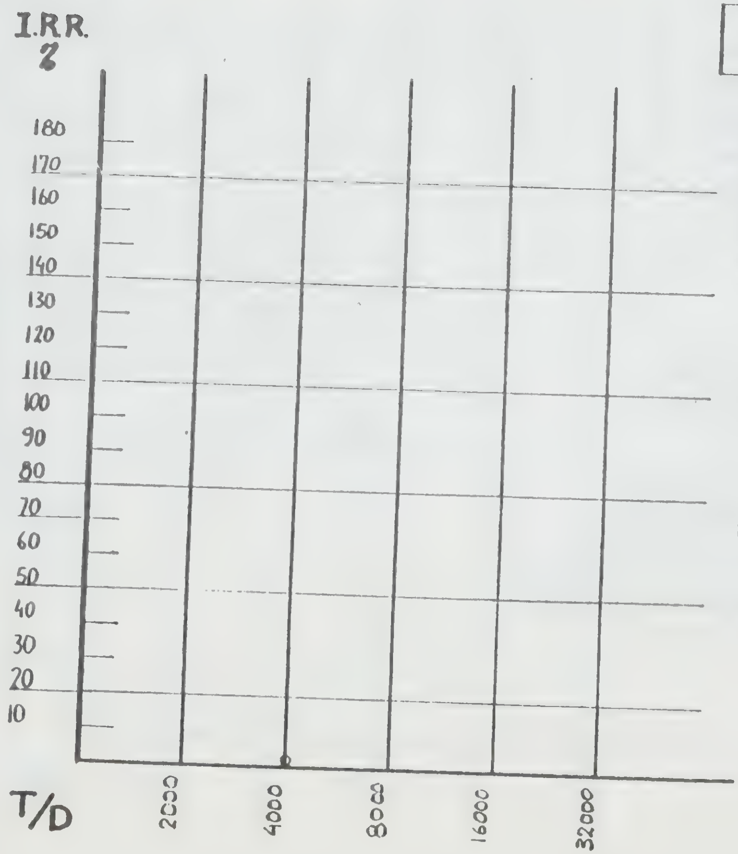
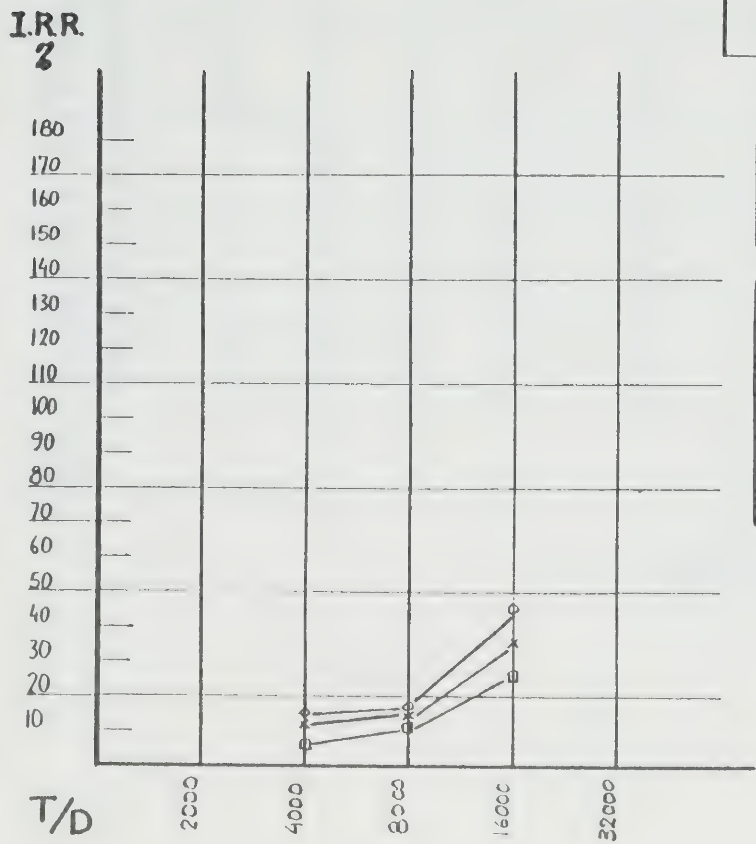


Fig 100

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 2



METAL: Cu Zn
METHOD: OPEN PIT

LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
□ 75 %
× 50 %
○ 25 %

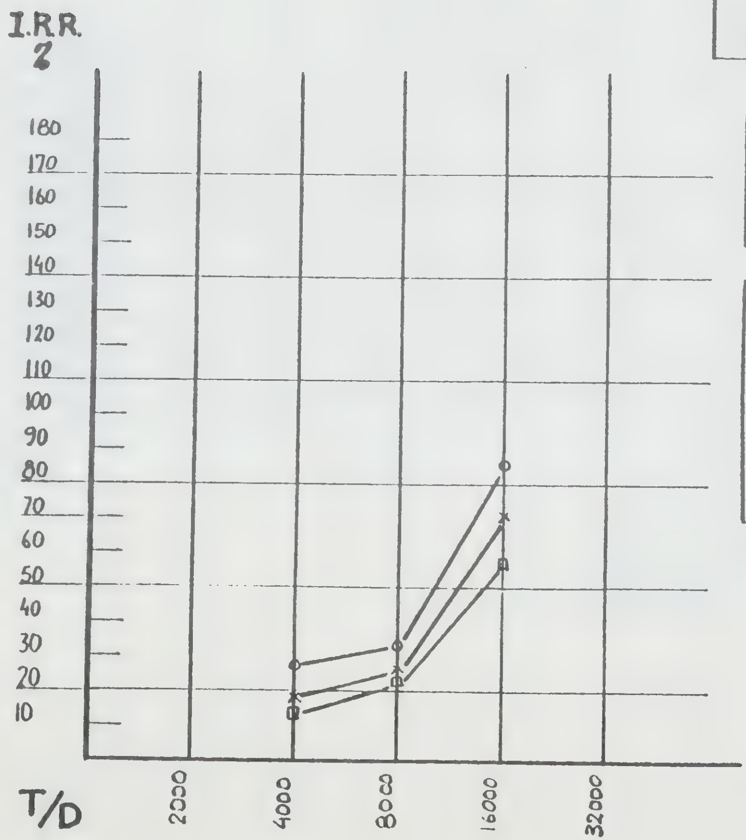
Fig.100

Fig. 101

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 2

METAL: Cu Pb Zn
METHOD: OPEN PIT



LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
□ 75 %
× 50 %
o 25 %

Fig. 101

Fig. 102

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 2

METAL: PbZn
METHOD: OPEN PIT

LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
□ 75 %
× 50 %
○ 25 %

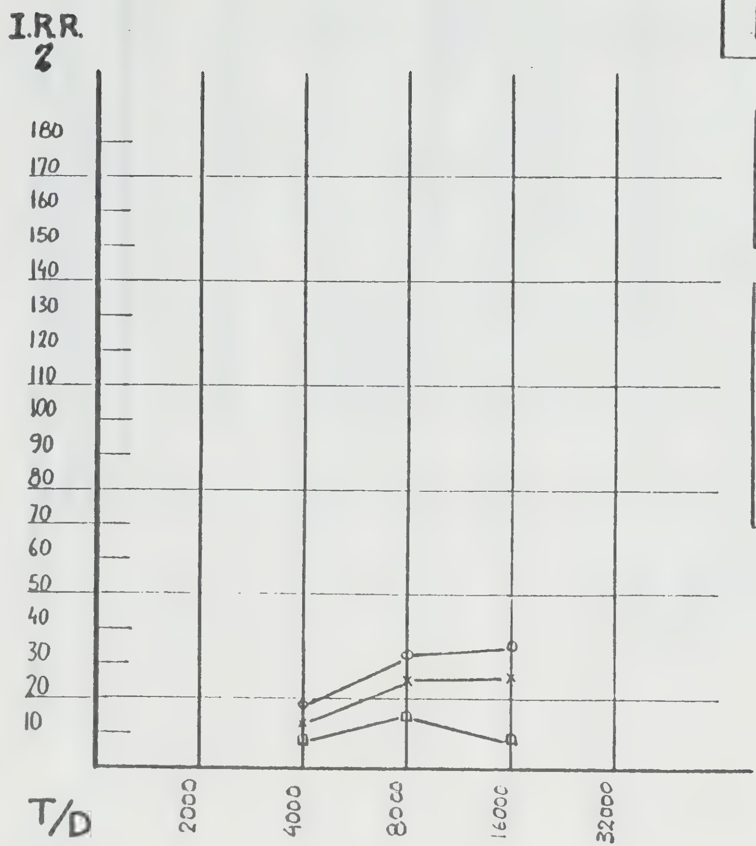


Fig. 102

Fig. 103

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 2

METAL: Ni Cu
METHOD: OPEN PIT

LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
□ 75 %
× 50 %
○ 25 %

Fig. 103

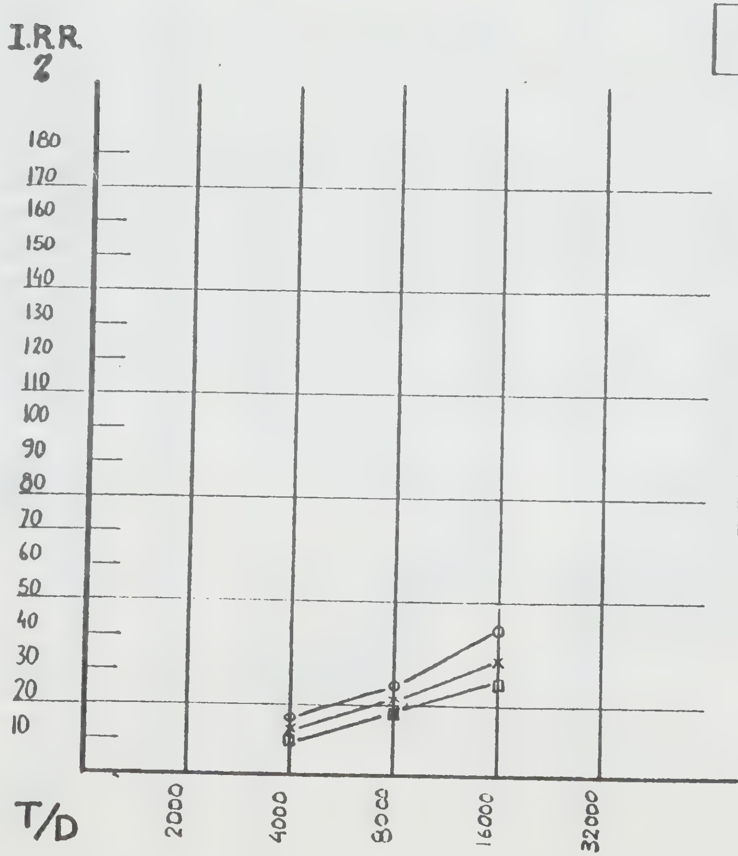


Fig. 104

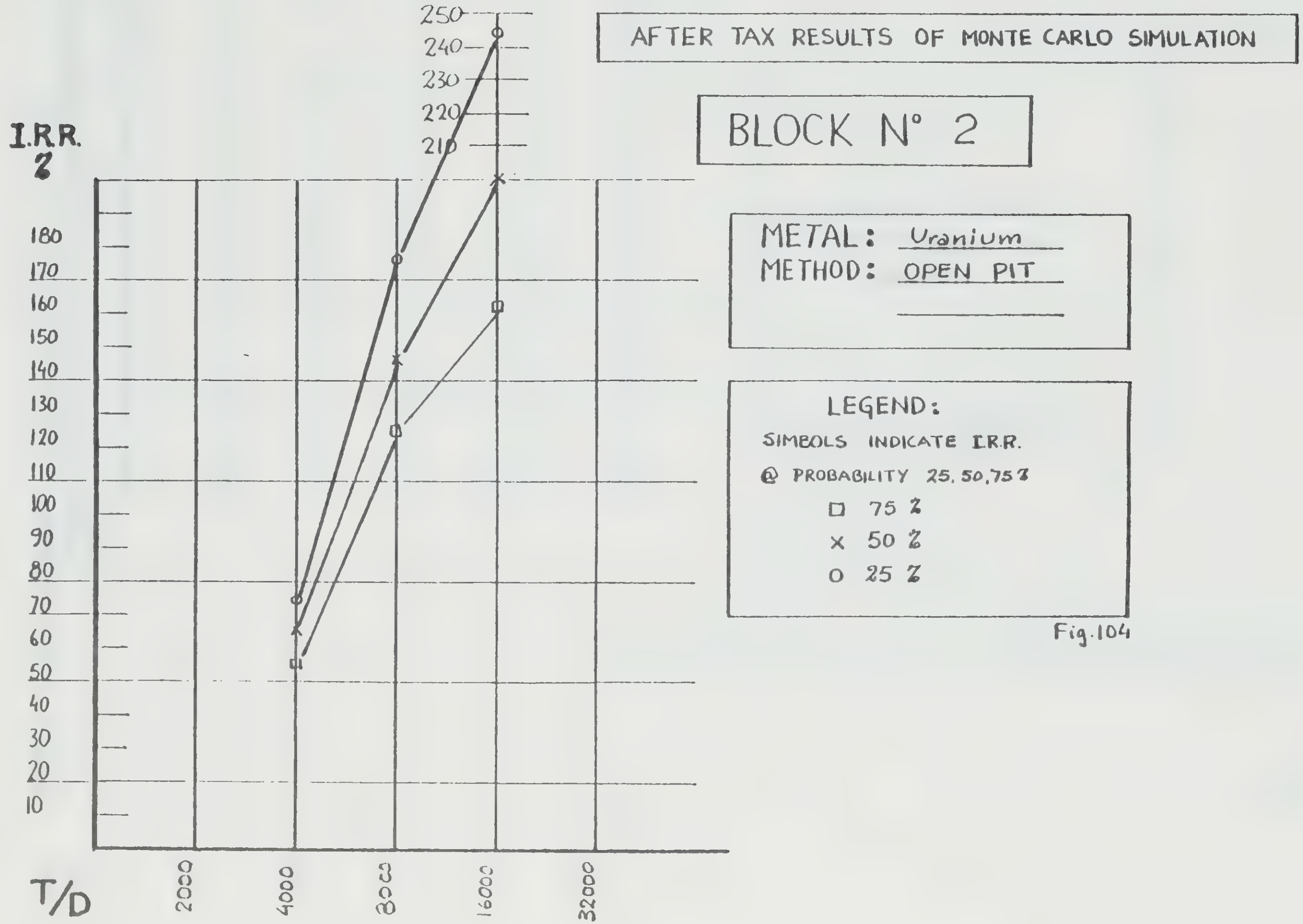

AFTER TAX RESULTS OF MONTE CARLO SIMULATION
BLOCK N° 2
METAL: Uranium
METHOD: OPEN PIT
LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
□ 75 %
x 50 %
o 25 %
Fig.104
I.R.R. %
250
240
230
220
210
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
T/D
2000
4000
8000
16000
32000

Fig. 105

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 2

METAL: Gold
METHOD: OPEN PIT

LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
□ 75 %
× 50 %
○ 25 %

Fig. 105

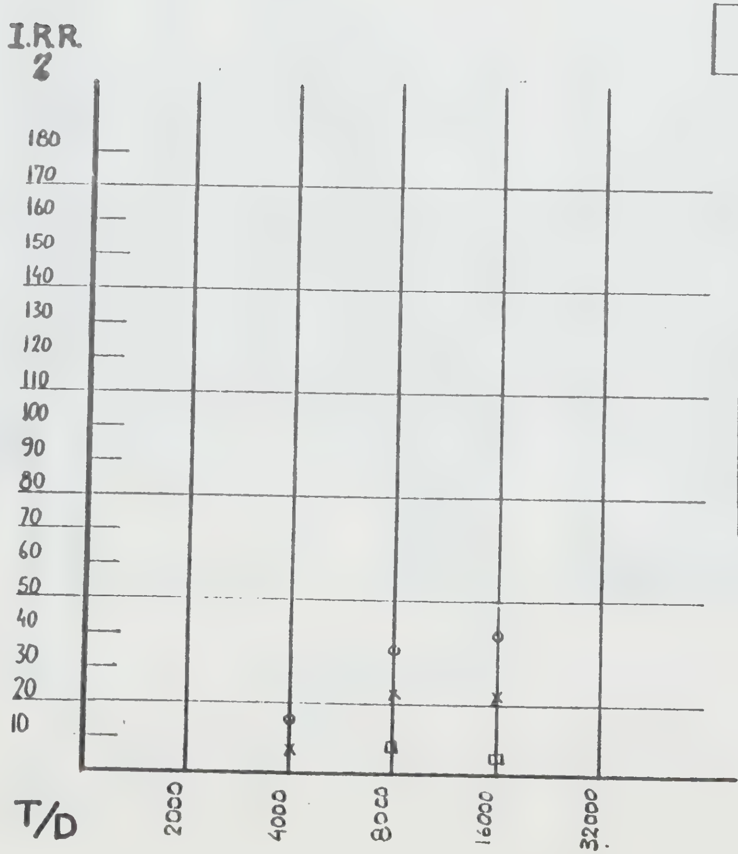
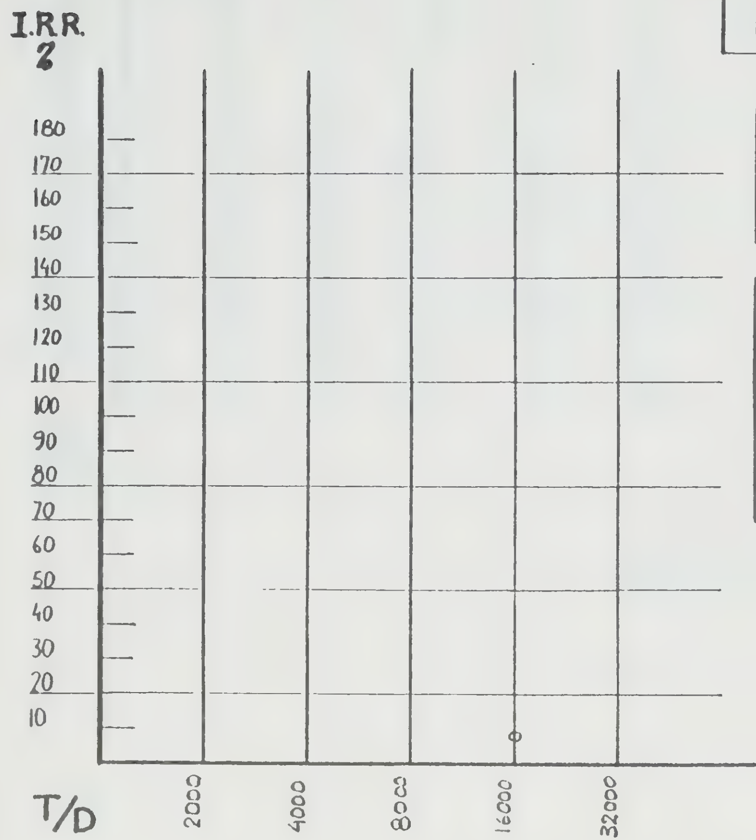


Fig. 106

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 2

METAL: Silver
METHOD: OPEN PIT



LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
□ 75 %
× 50 %
o 25 %

Fig. 106

Fig. 107

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 2

METAL: Iron
METHOD: OPEN PIT

LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
□ 75 %
× 50 %
o 25 %

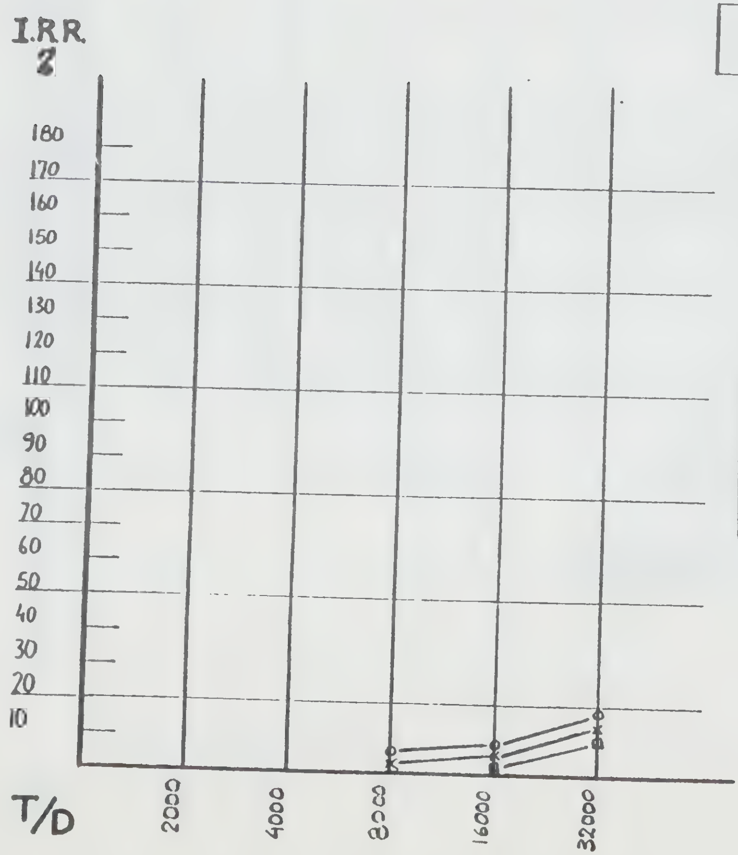


Fig. 107

Fig. 108

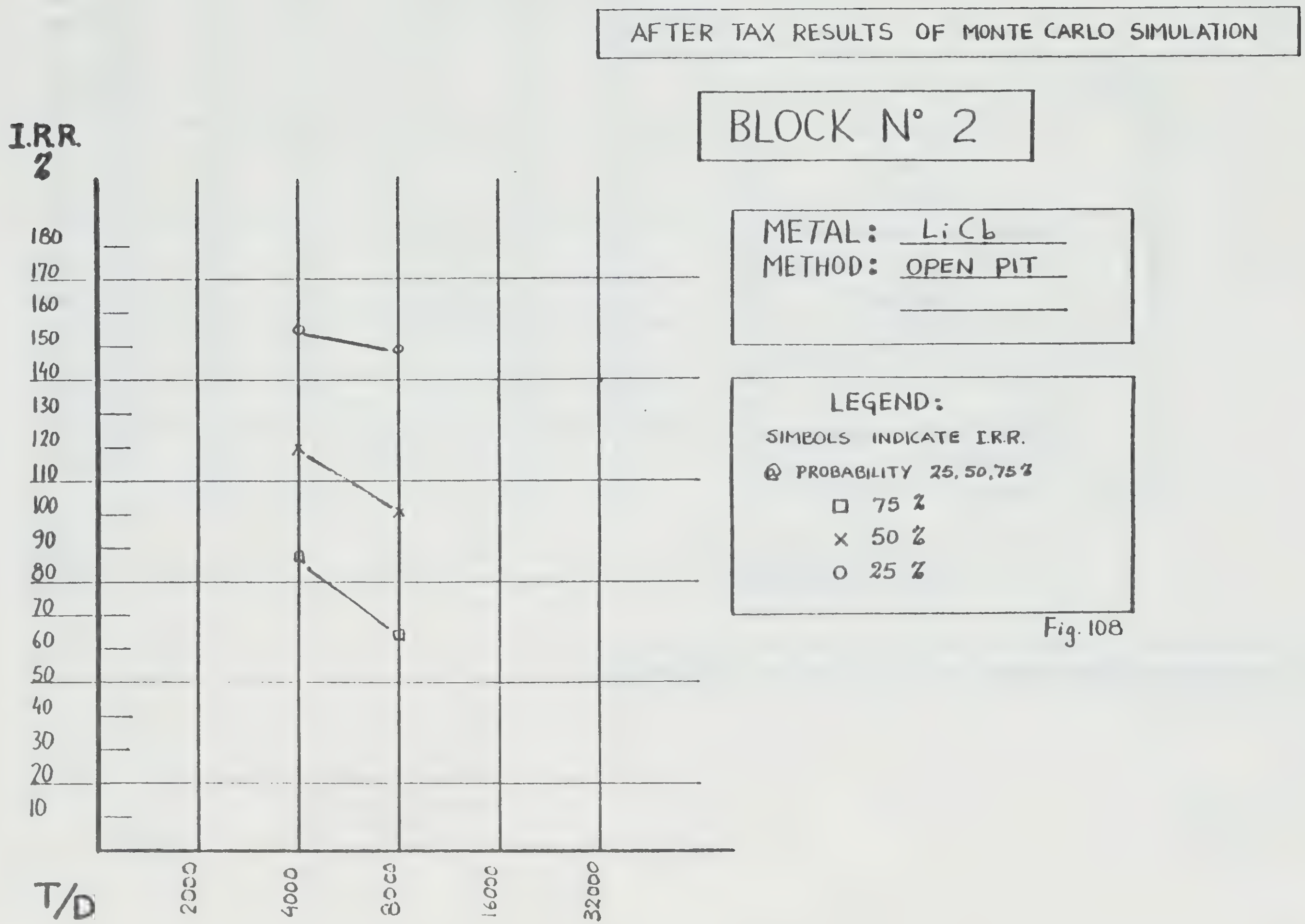


Fig. 108

Fig. 109

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 3

METAL: Copper
METHOD: OPEN PIT

LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
□ 75 %
× 50 %
o 25 %

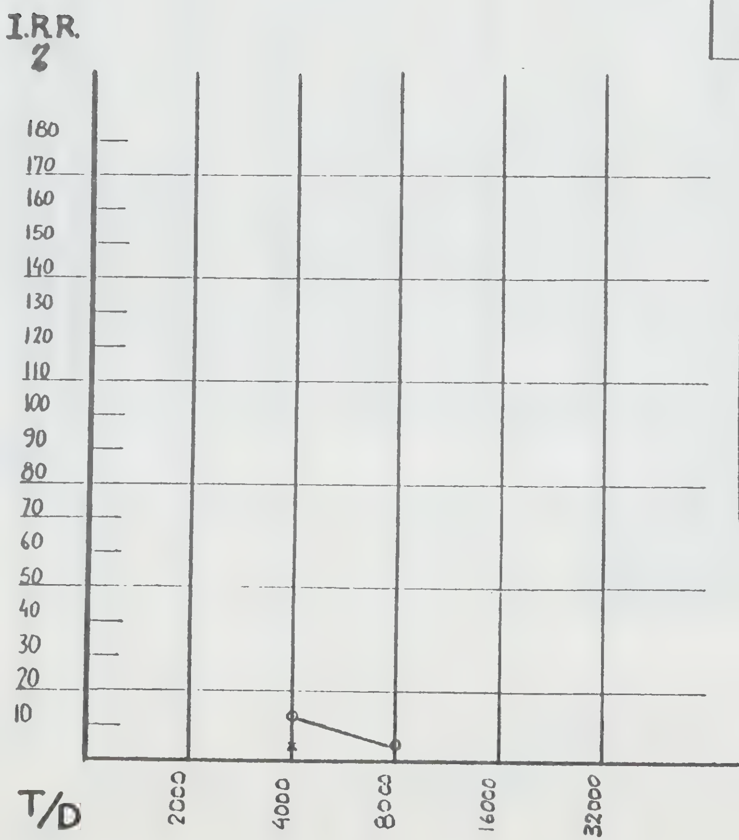


Fig. 109

Fig. 110

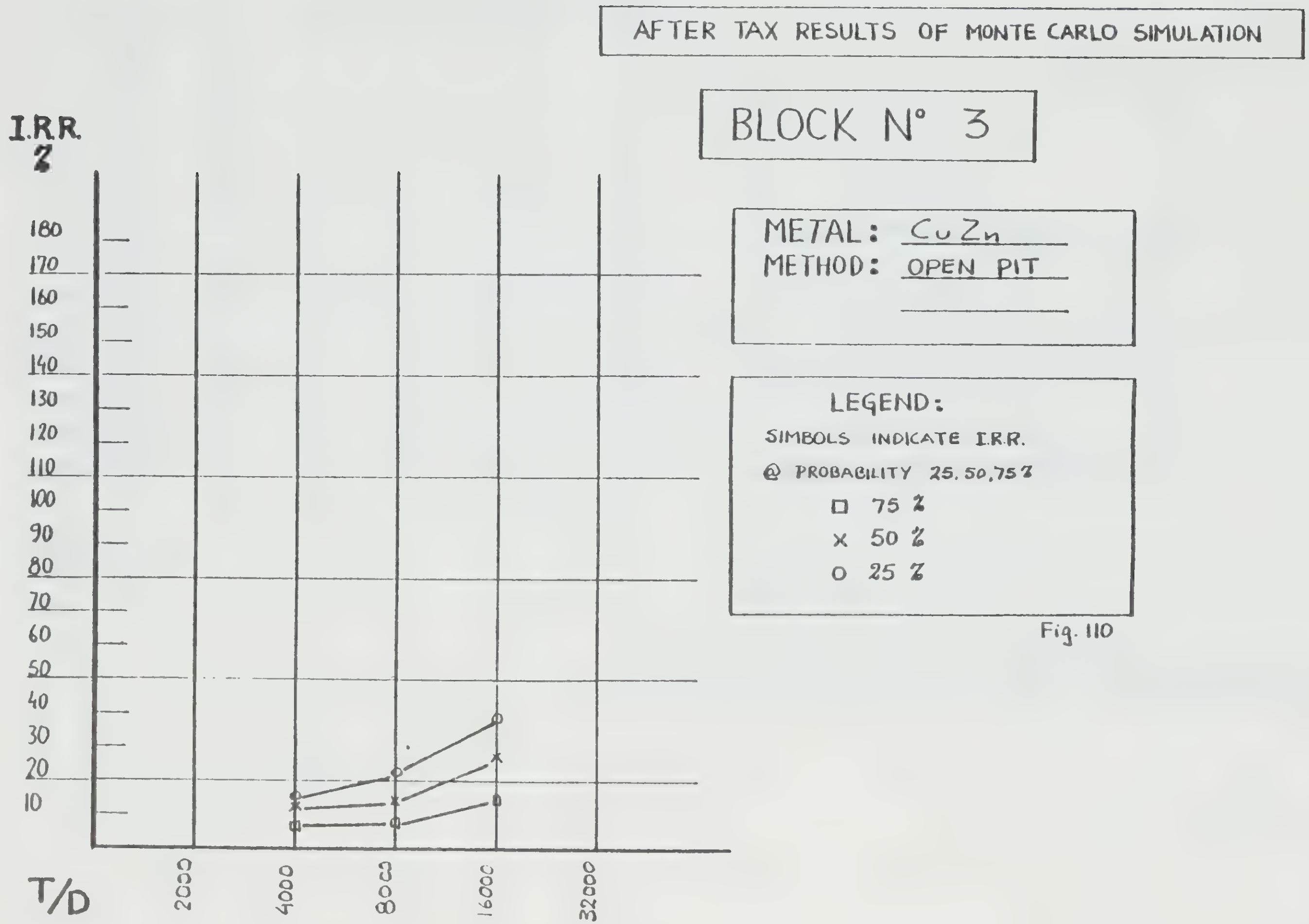


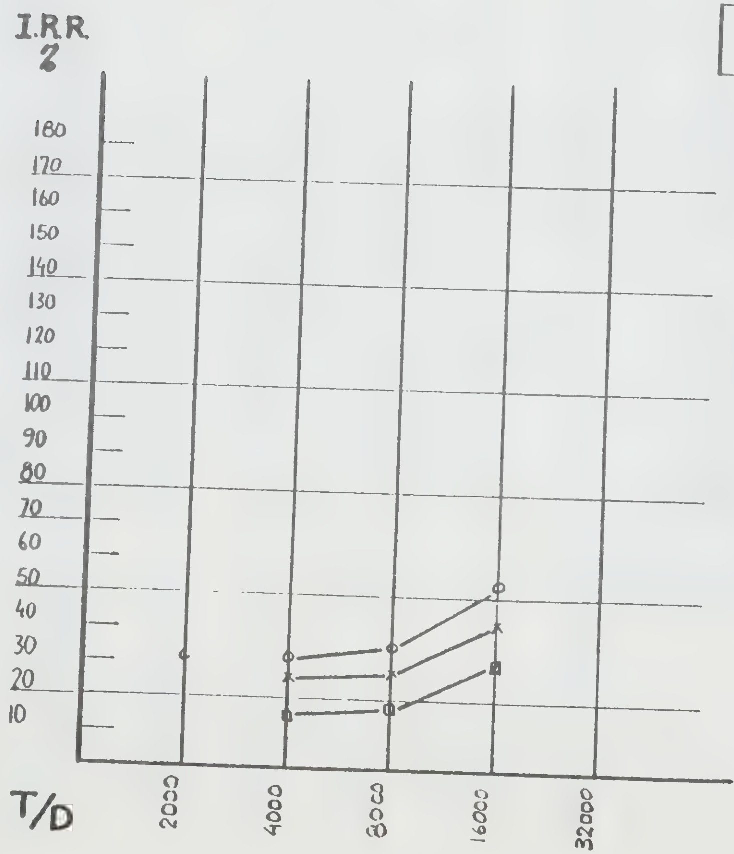
Fig. 110

Fig. 111

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 3

METAL: Cu Pb Zn
METHOD: OPEN PIT



LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
□ 75 %
× 50 %
○ 25 %

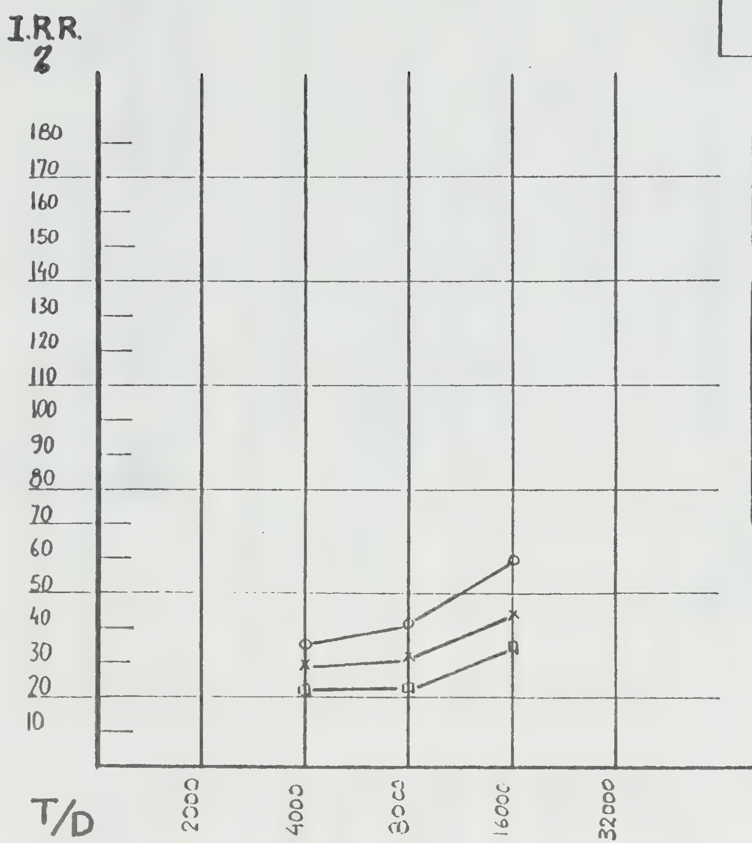
Fig. 111

Fig 112

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 3

METAL: PbZn
METHOD: OPEN PIT



LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
□ 75 %
× 50 %
○ 25 %

Fig. 112

Fig. 113

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 3

METAL: NiCu
METHOD: OPEN PIT

LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
□ 75 %
× 50 %
o 25 %

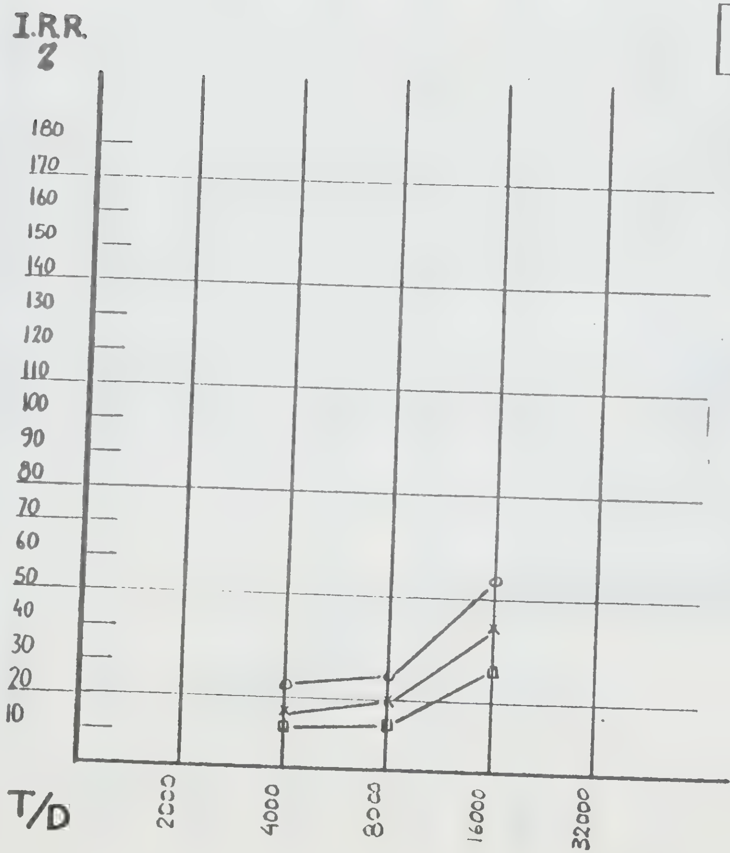


Fig. 113

Fig. 114.

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 3

METAL: Uranium
METHOD: OPEN PIT

LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
□ 75 %
× 50 %
○ 25 %

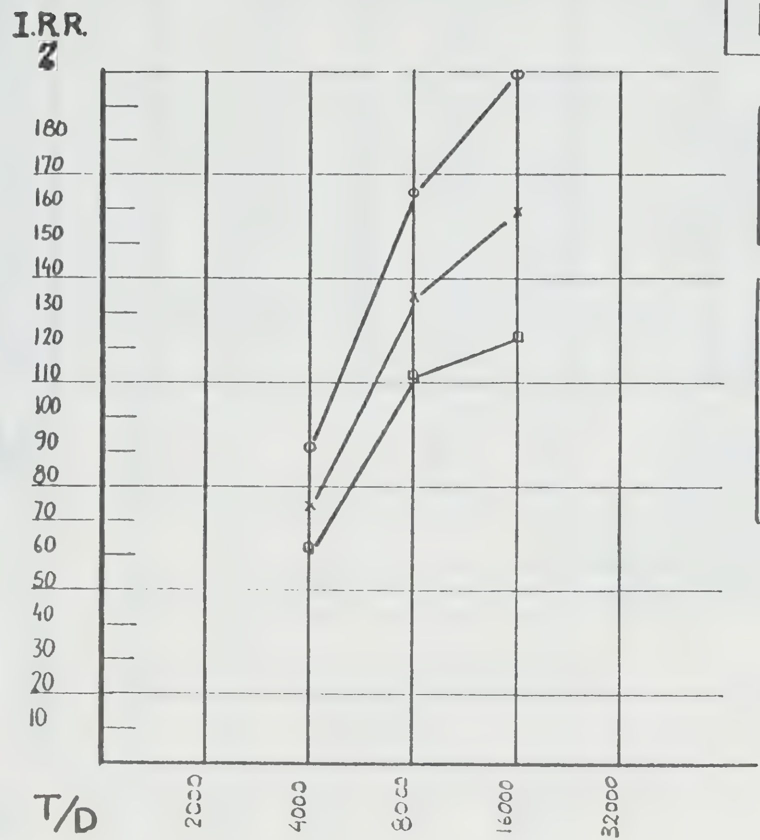


Fig. 114

Fig. 115

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 3

METAL: Gold
METHOD: OPEN PIT

LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
□ 75 %
× 50 %
○ 25 %

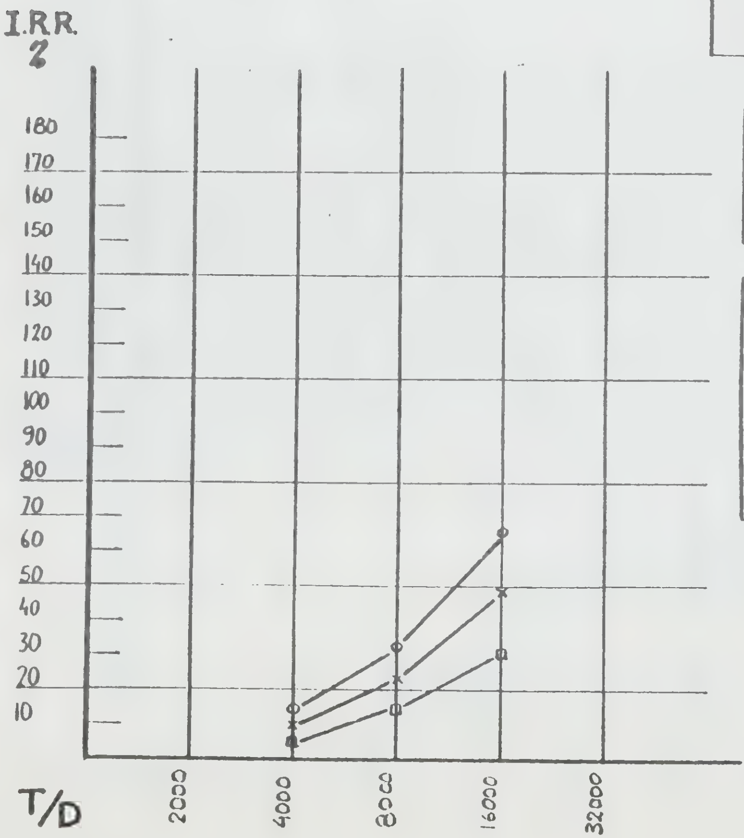
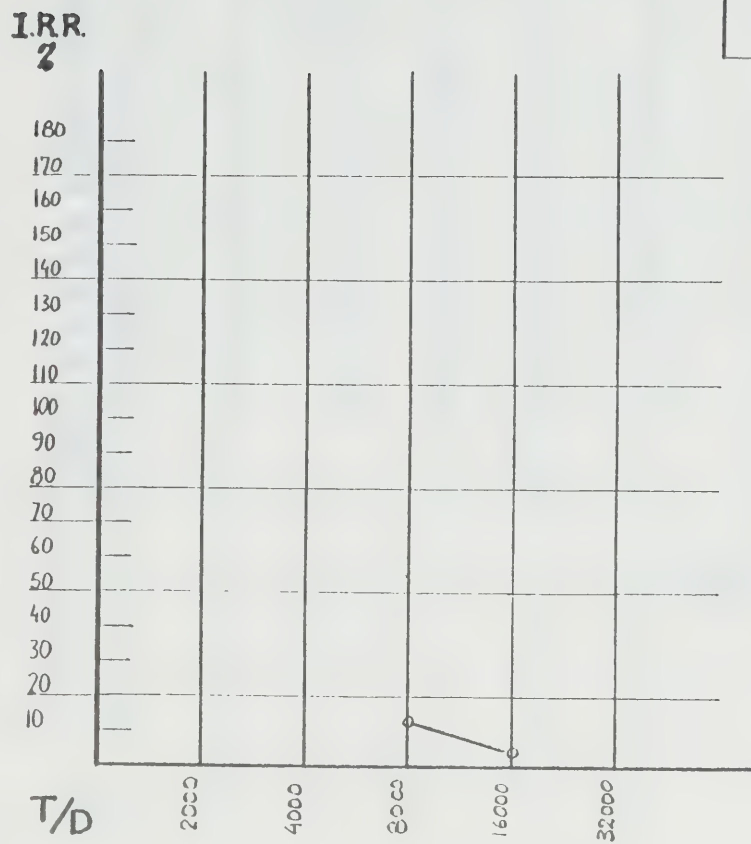


Fig. 115

Fig. 116

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 3



METAL: Silver
METHOD: OPEN PIT

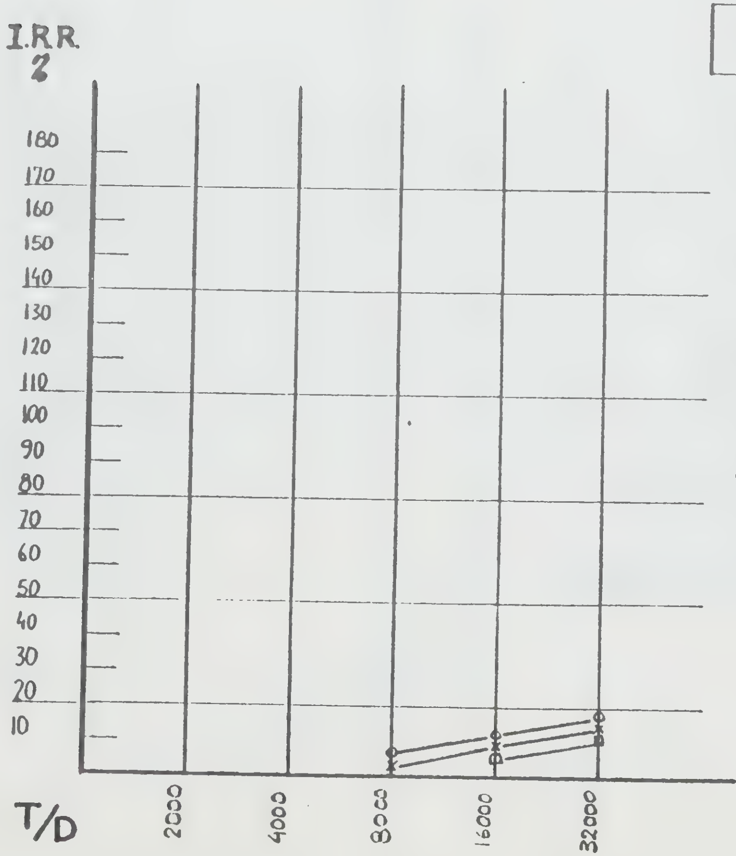
LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
□ 75 %
× 50 %
○ 25 %

Fig. 116

Fig. 117

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 3



METAL: Iron
METHOD: OPEN PIT

LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
□ 75 %
× 50 %
○ 25 %

Fig. 117

Fig. 118

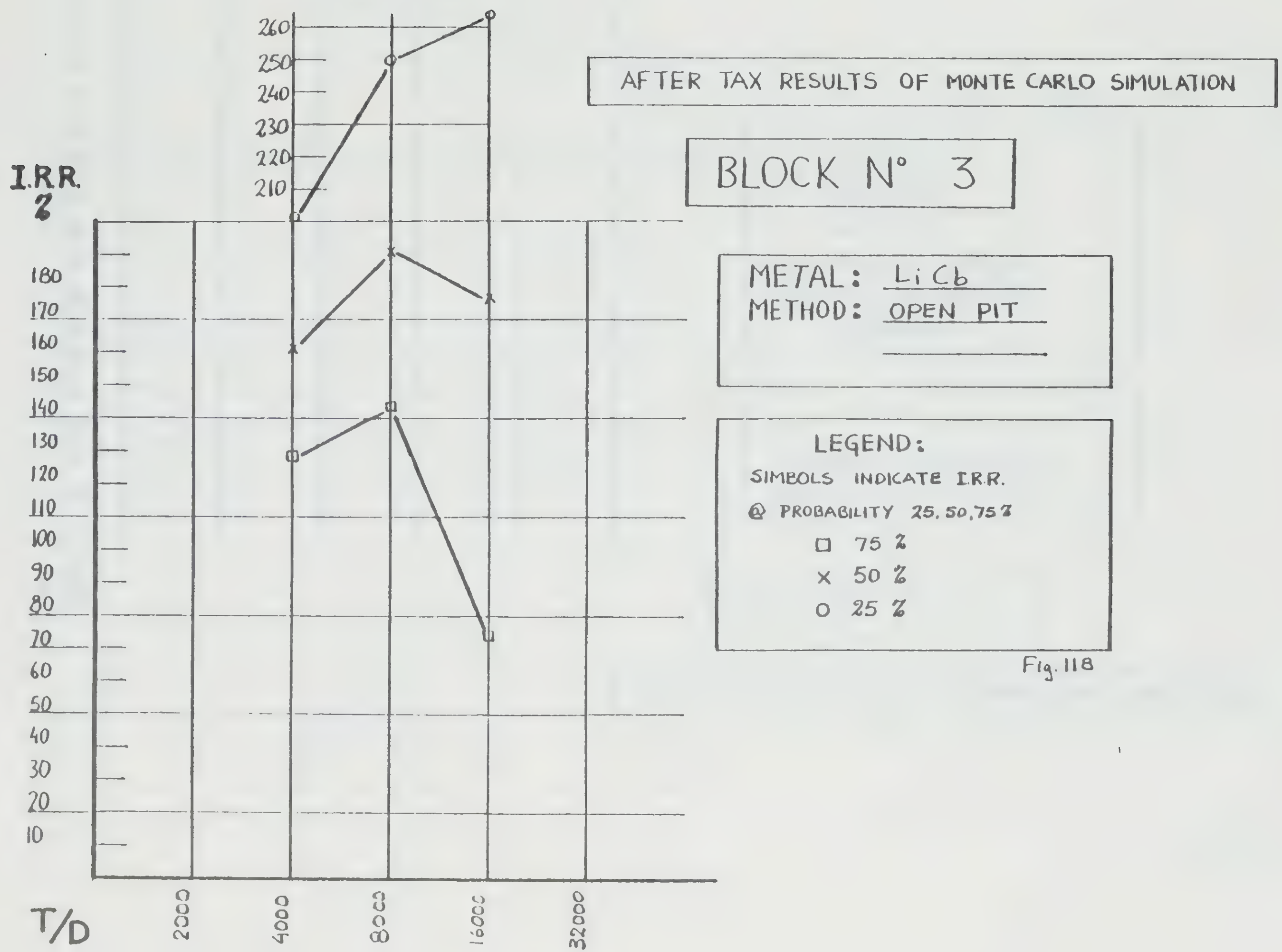


Fig. 118

Fig 119

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 4

METAL: CuZn
METHOD: OPEN PIT

LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
□ 75 %
x 50 %
o 25 %

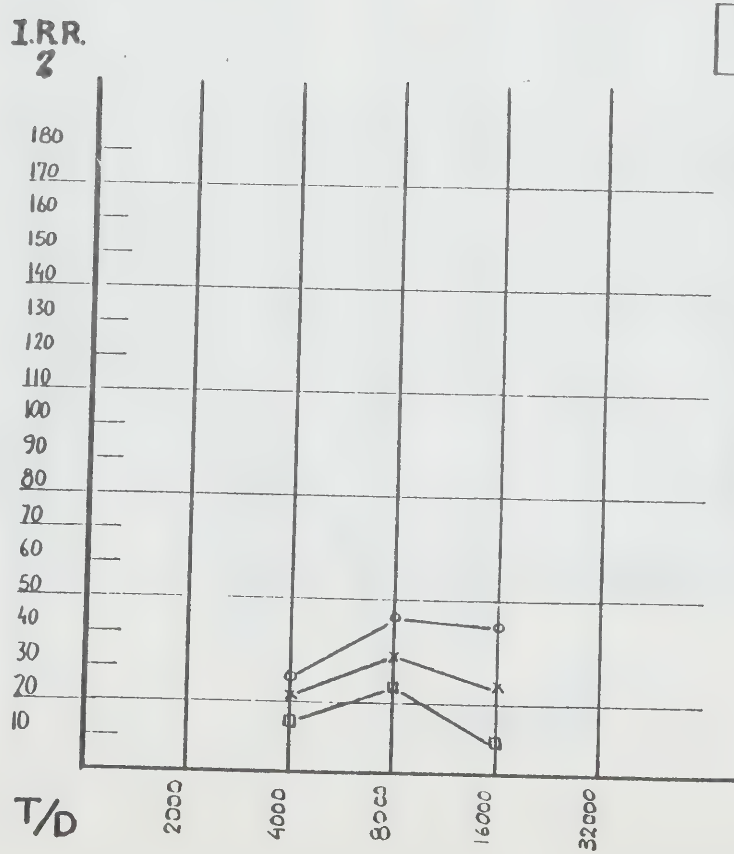


Fig. 119

Fig 120

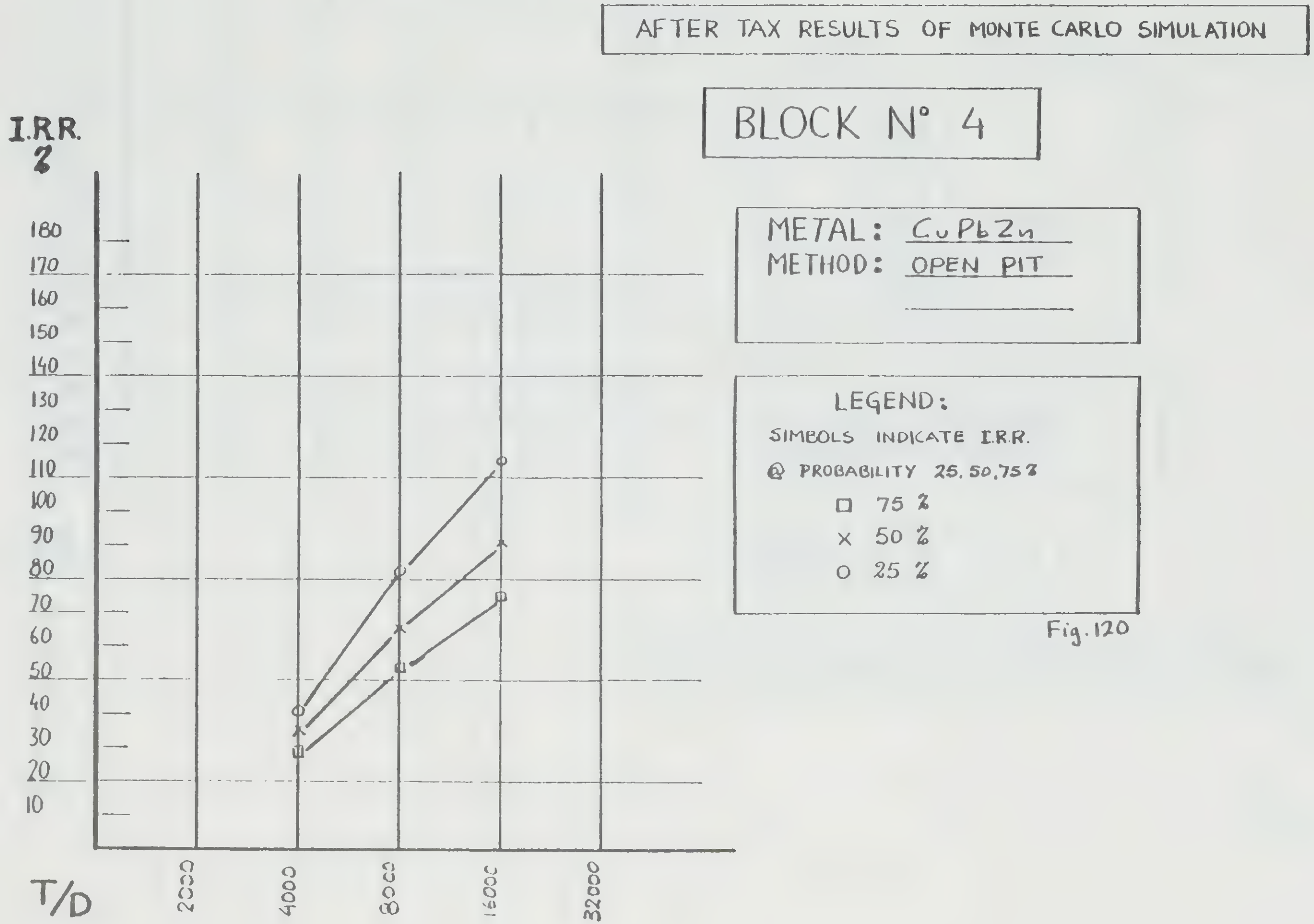


Fig. 120

Fig. 121

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 4

METAL: PbZn
METHOD: OPEN PIT

LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
□ 75 %
x 50 %
o 25 %

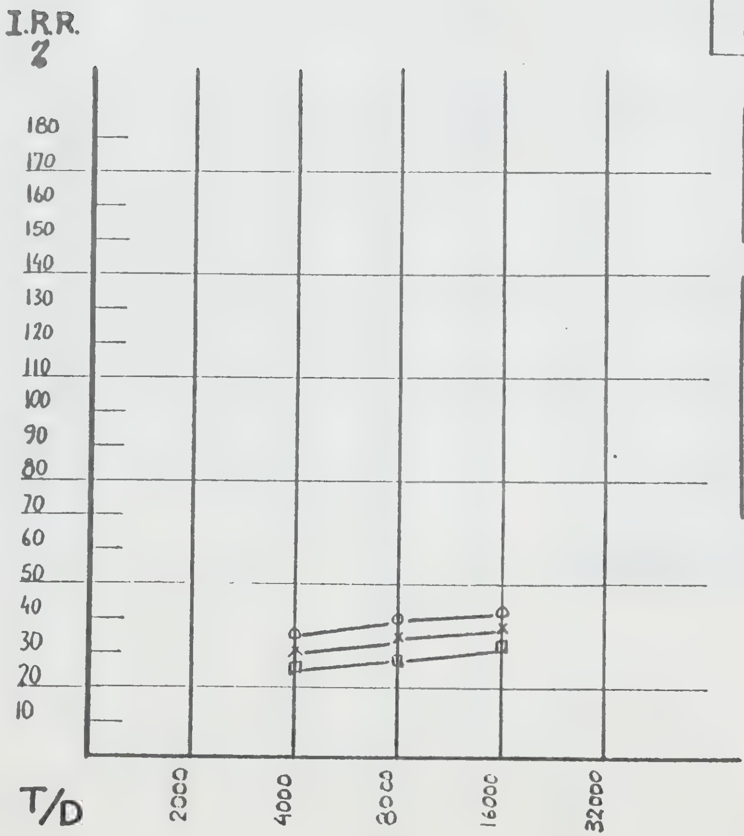


Fig. 121

Fig 122

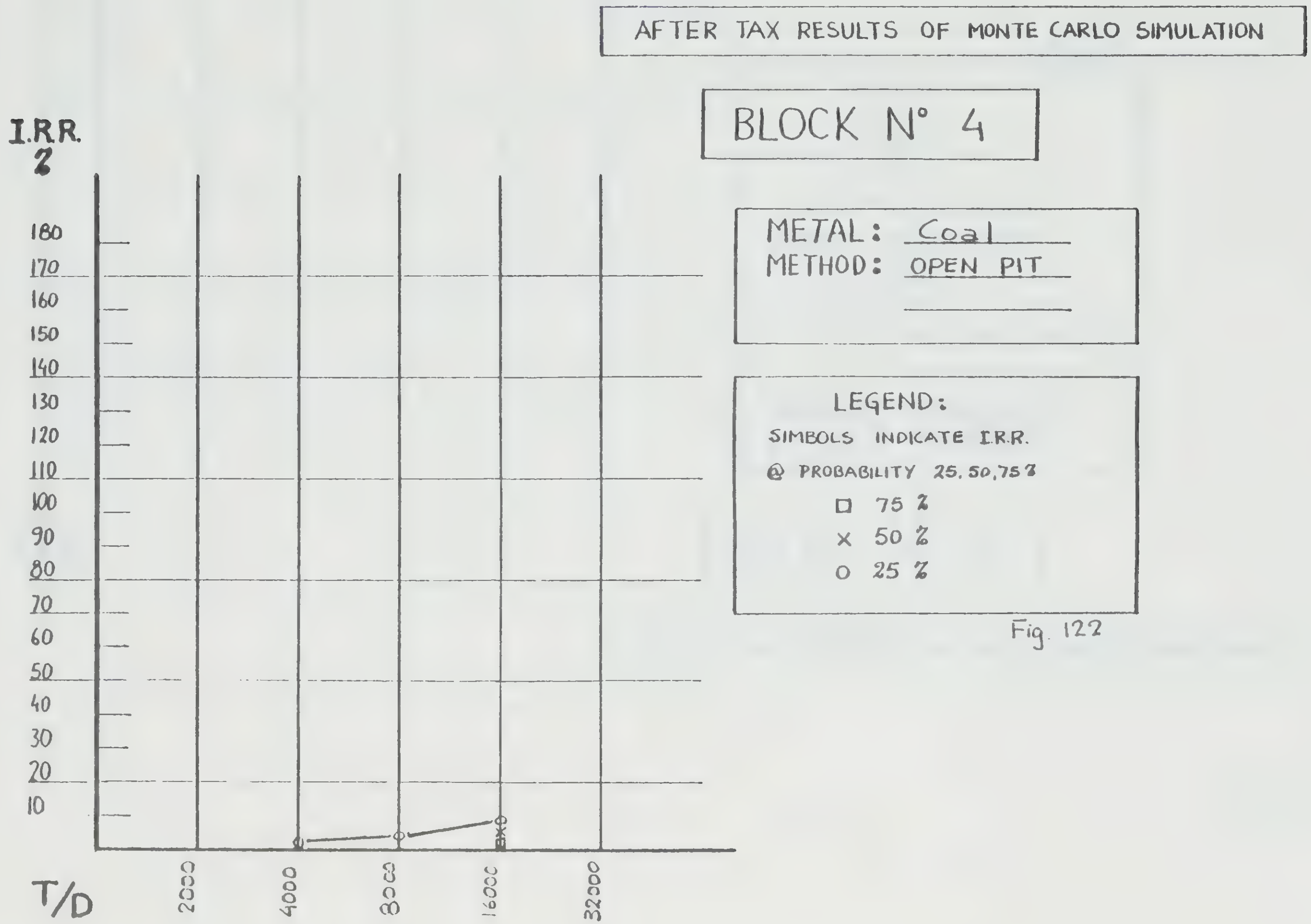


Fig. 122

Fig. 123

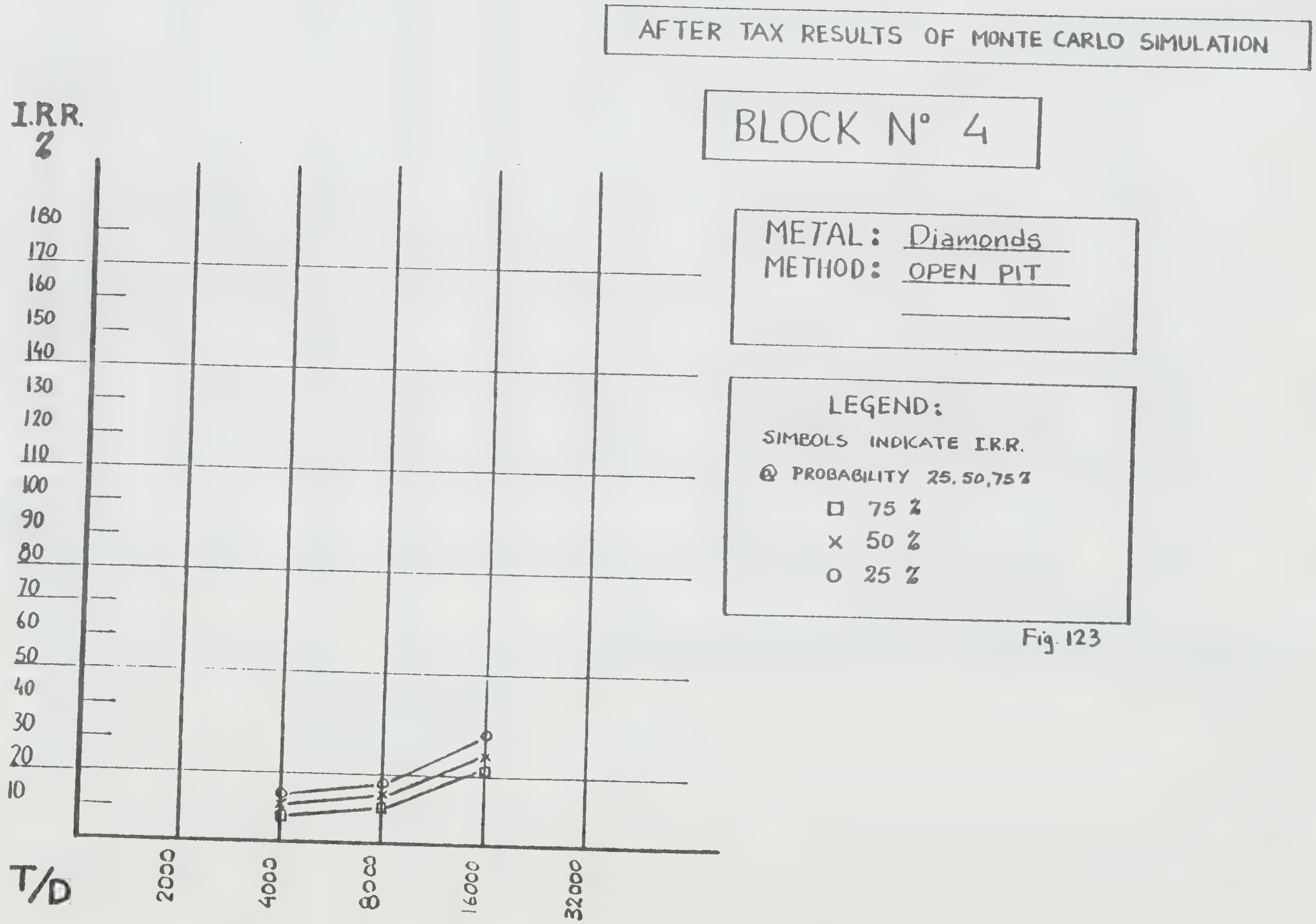


Fig. 123

Fig 124

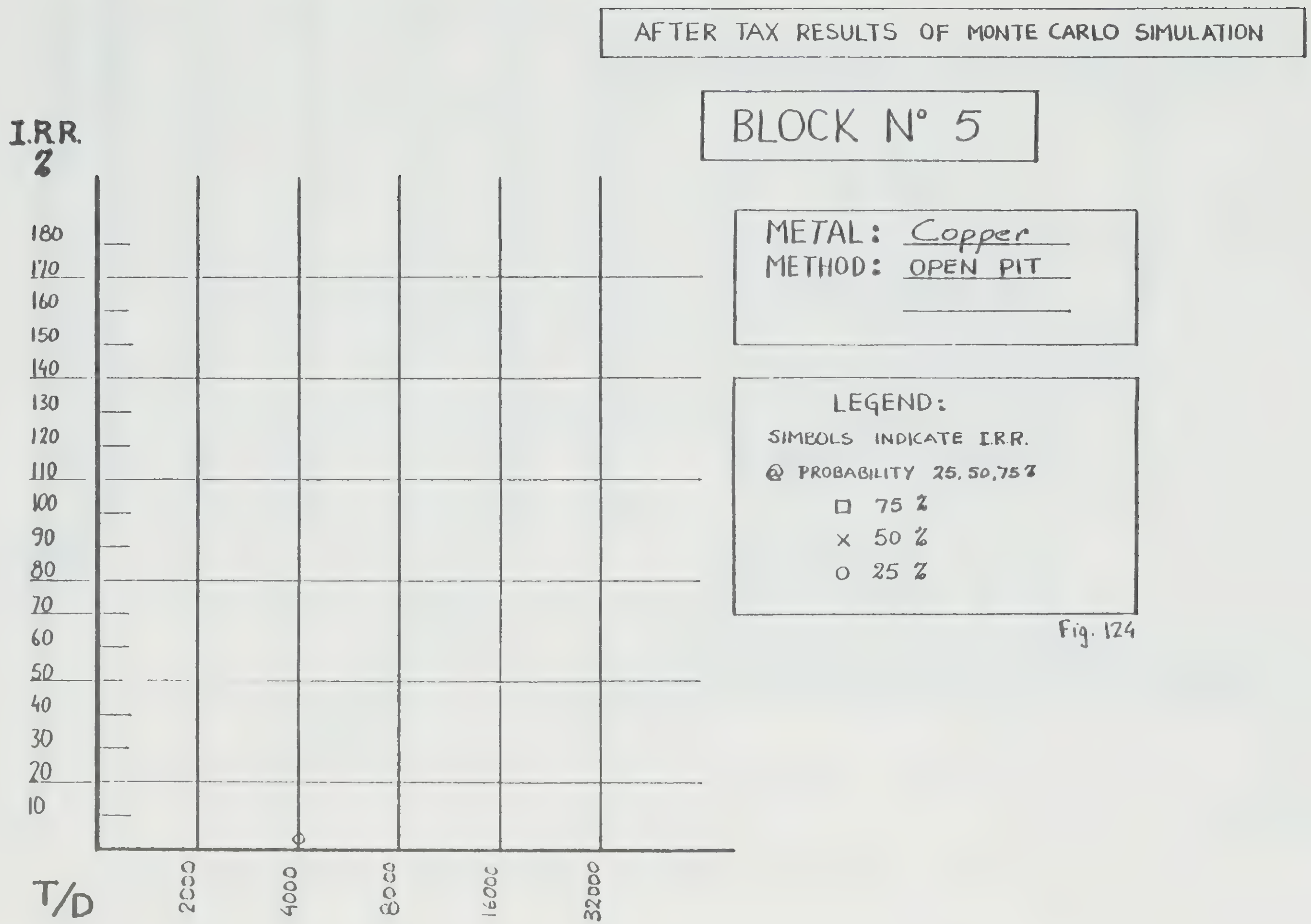


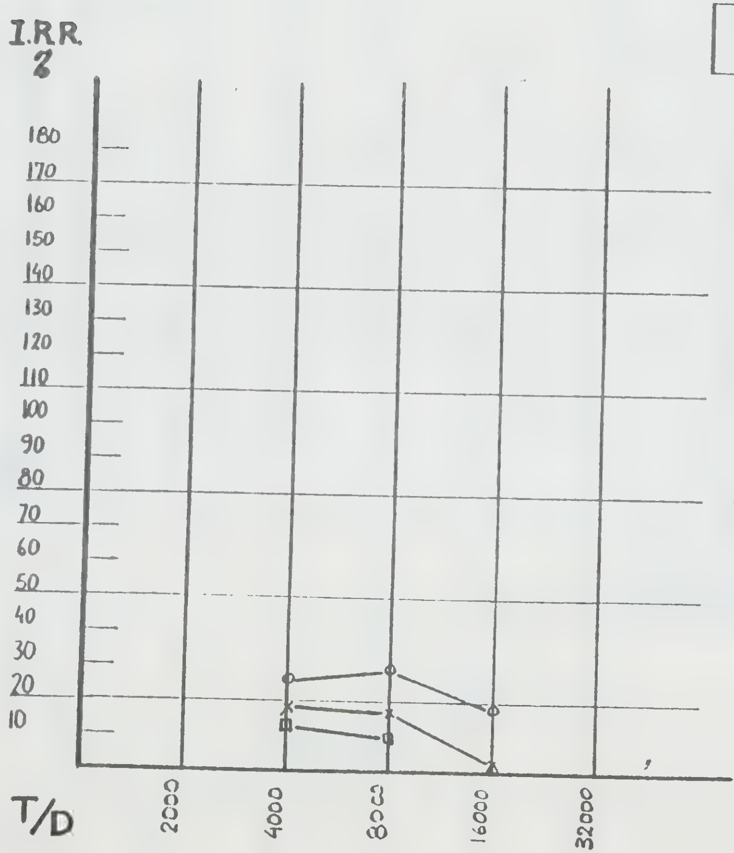
Fig. 124

Fig. 125

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 5

METAL: CuZn
METHOD: OPEN PIT



LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
□ 75 %
× 50 %
o 25 %

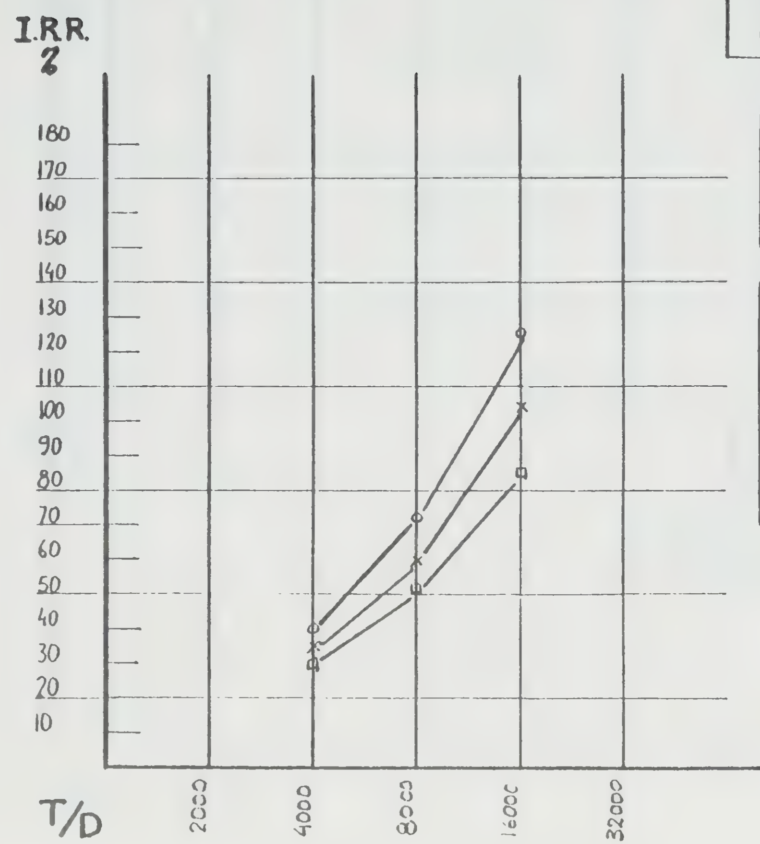
Fig. 125

Fig. 126

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 5

METAL: CuPbZn
METHOD: OPEN PIT



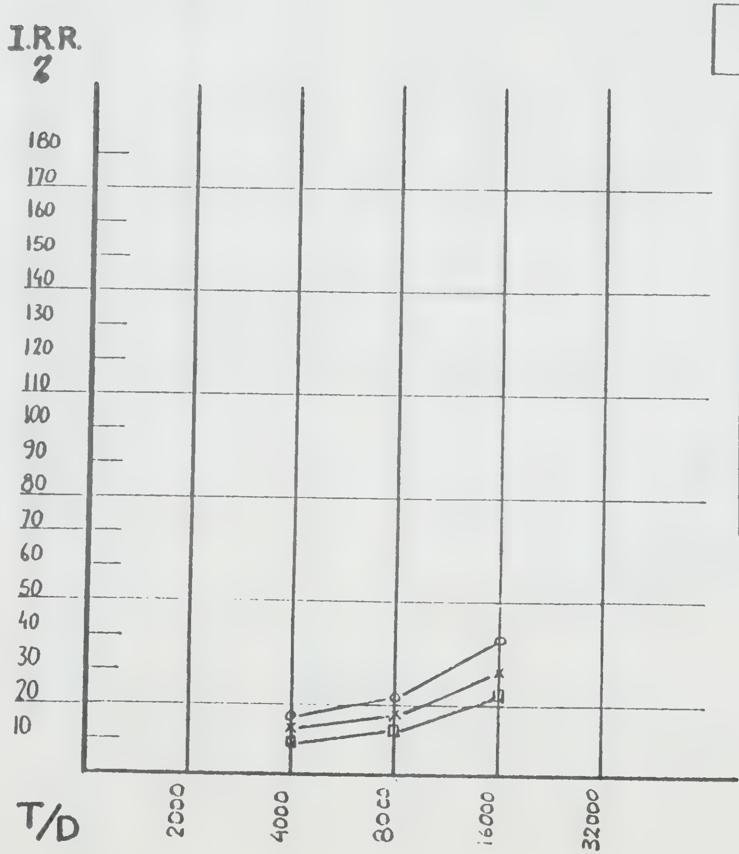
LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
□ 75 %
× 50 %
o 25 %

Fig. 126

Fig 127

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 5



METAL: $PbZn$
METHOD: OPEN PIT

LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
□ 75 %
× 50 %
○ 25 %

Fig. 127

Fig 128

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 5

METAL: Uranium
METHOD: OPEN PIT

LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
□ 75 %
× 50 %
o 25 %

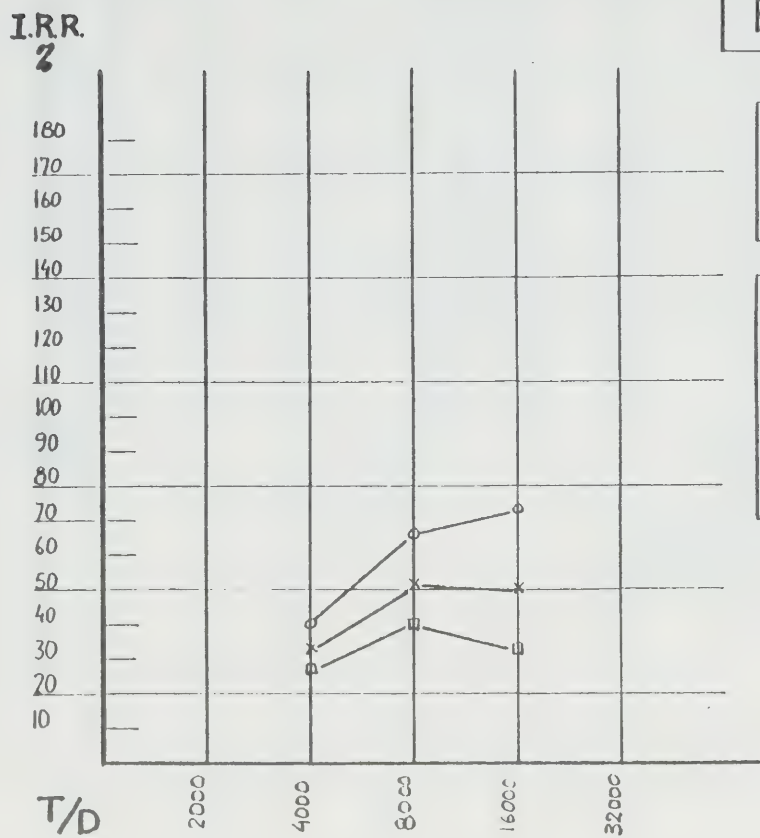


Fig. 128

Fig. 129

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 5

METAL: Silver
METHOD: OPEN PIT

LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
□ 75 %
× 50 %
o 25 %

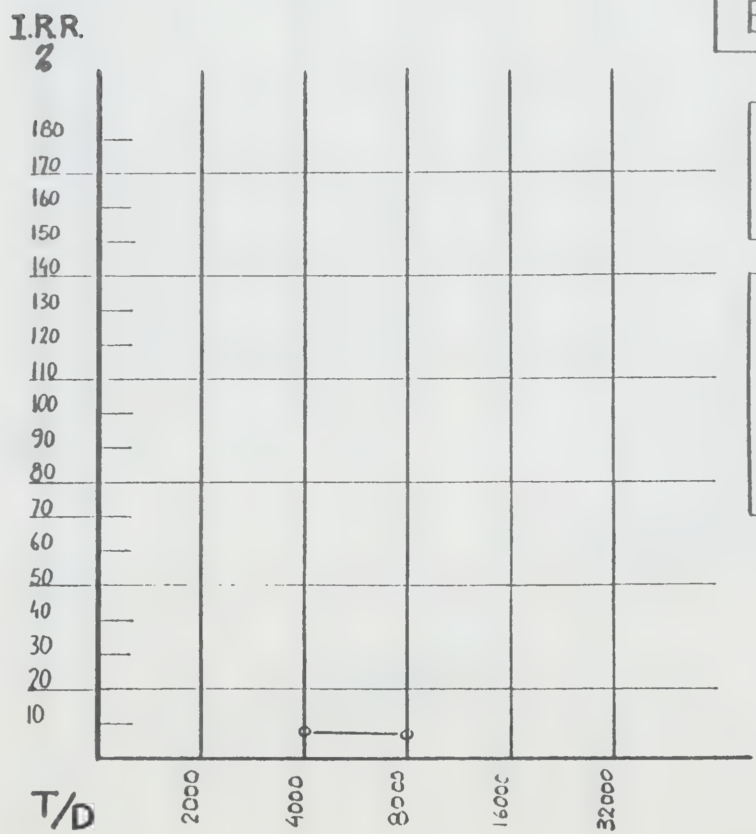


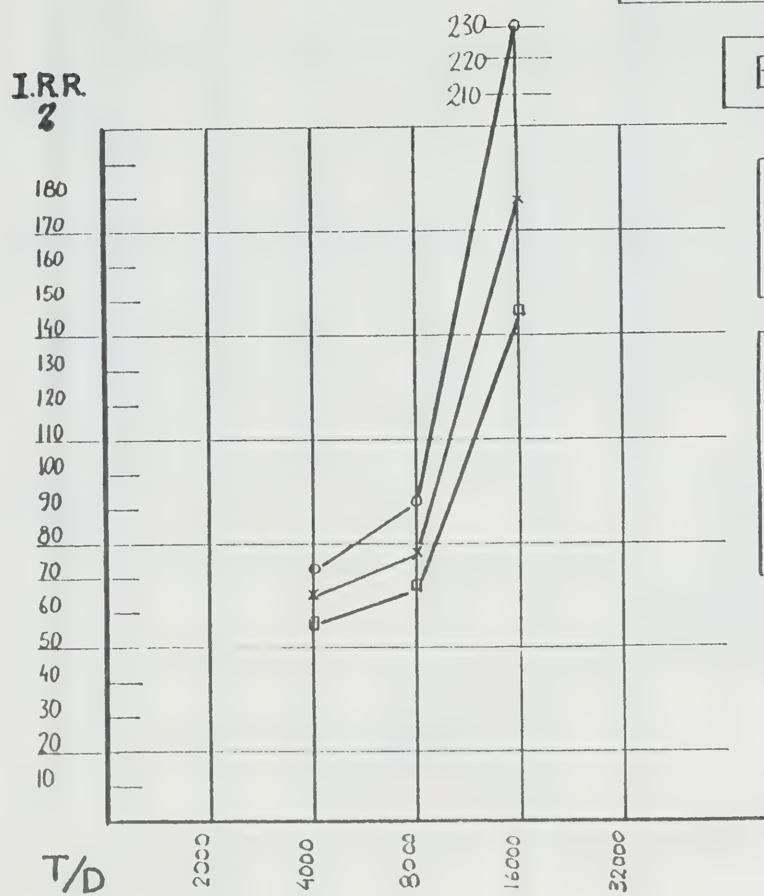
Fig. 129

Fig. 130

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 5

METAL: LiCb
METHOD: OPEN PIT



LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
□ 75 %
× 50 %
○ 25 %

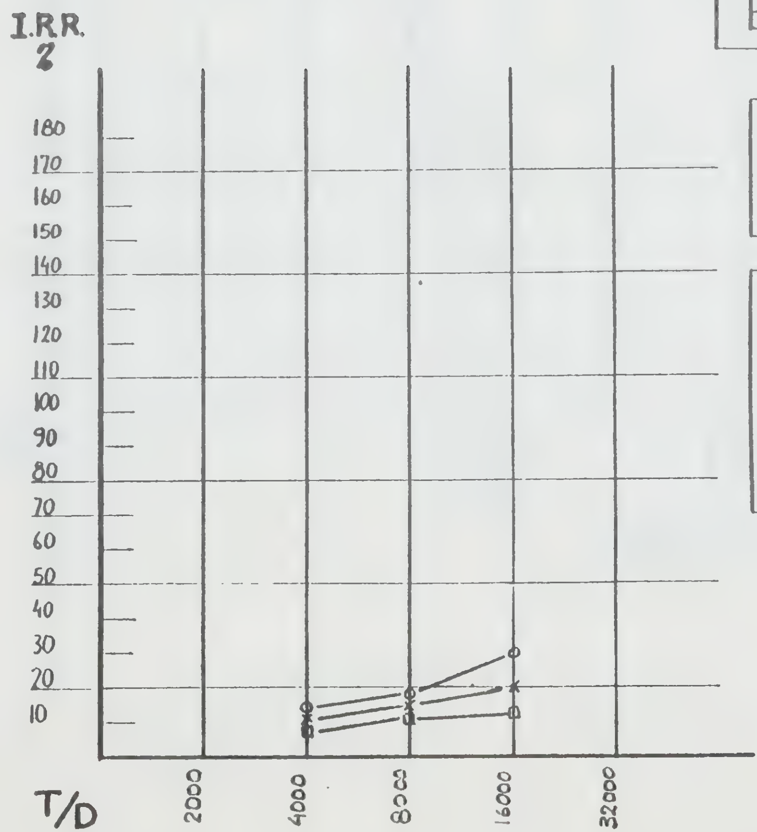
Fig. 130

Fig. 131

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 5

METAL: Diamonds
METHOD: OPEN PIT



LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
□ 75 %
x 50 %
o 25 %

Fig. 131

Fig. 132

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 6

METAL: CuZn
METHOD: OPEN PIT

LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
□ 75 %
× 50 %
○ 25 %

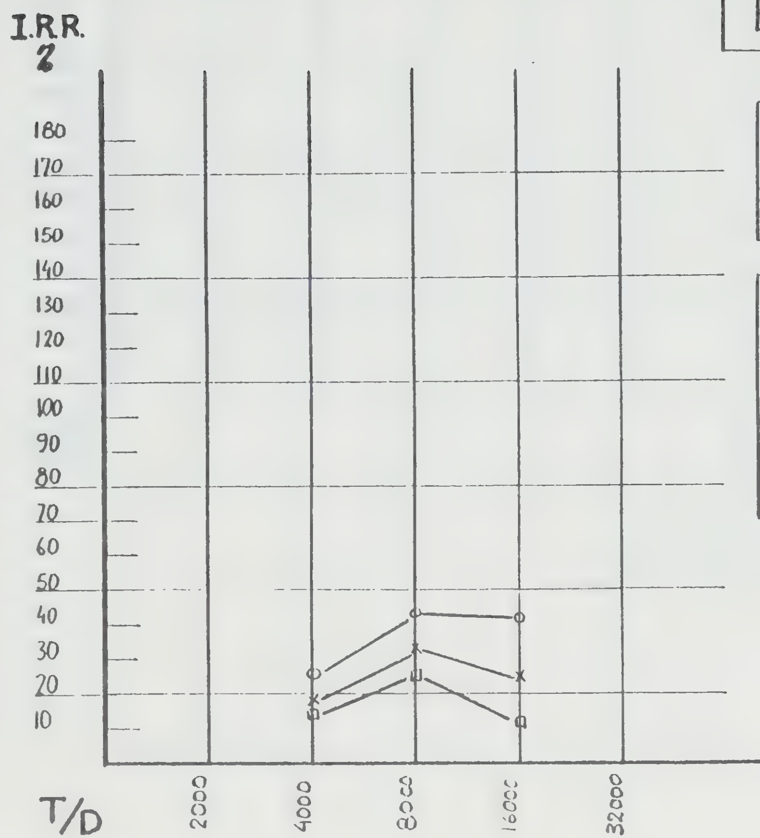


Fig. 132

Fig. 133

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 6

METAL: CuPbZn
METHOD: OPEN PIT

LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
□ 75 %
× 50 %
○ 25 %

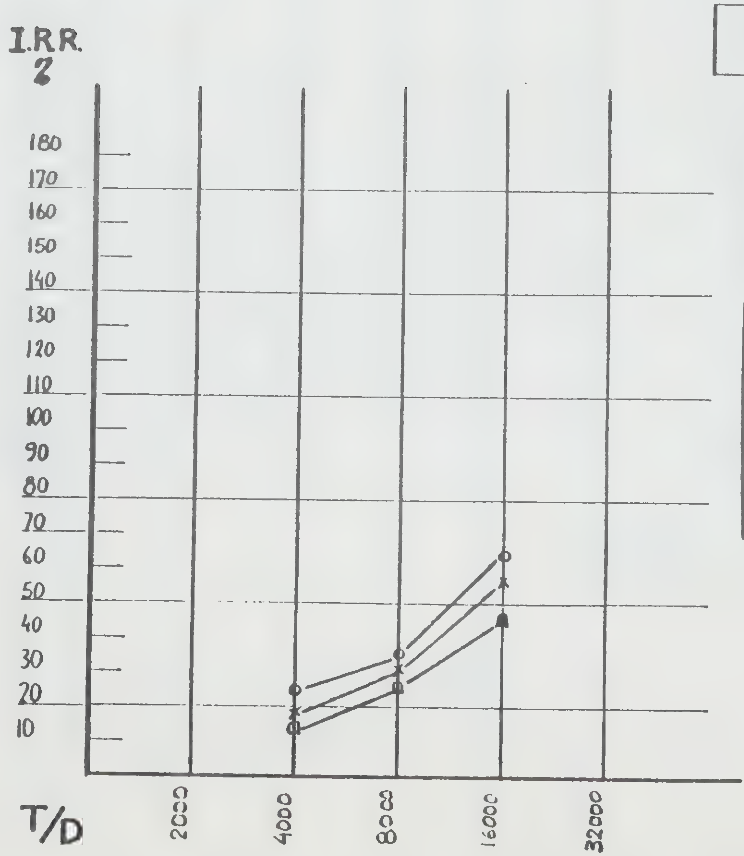


Fig. 133

Fig. 134

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 6

METAL: NiCu
METHOD: OPEN PIT

LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
□ 75 %
× 50 %
○ 25 %

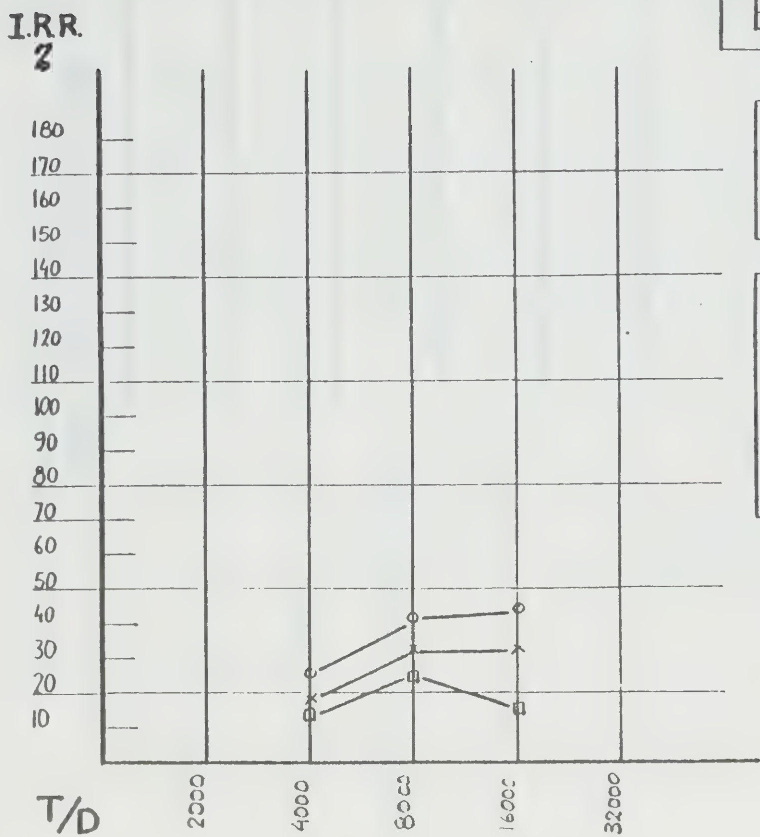


Fig. 134

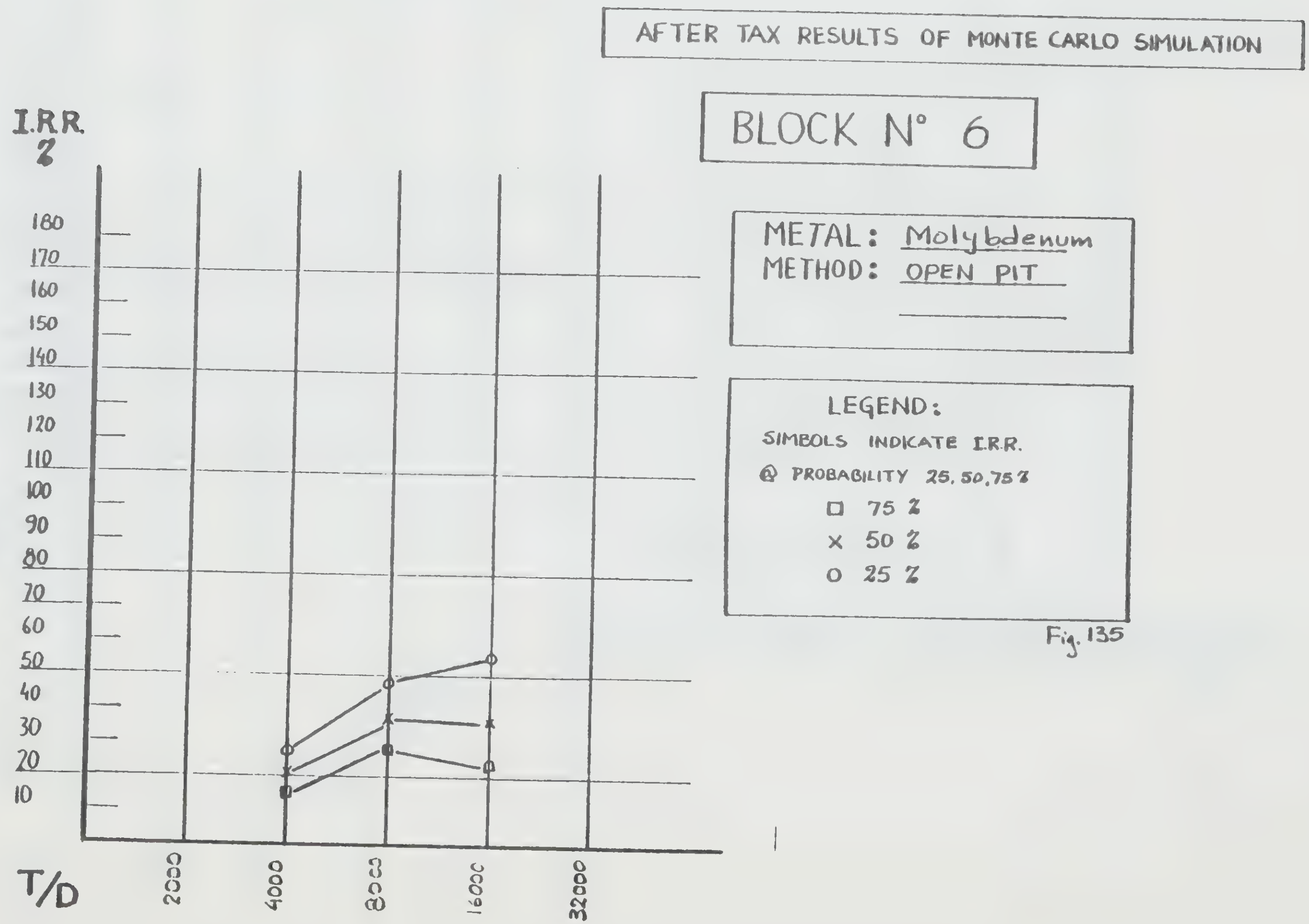

AFTER TAX RESULTS OF MONTE CARLO SIMULATION
BLOCK N° 6
METAL: Molybdenum
METHOD: OPEN PIT
LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
□ 75 %
x 50 %
o 25 %
I.R.R. %
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
T/D
2000
4000
8000
16000
32000

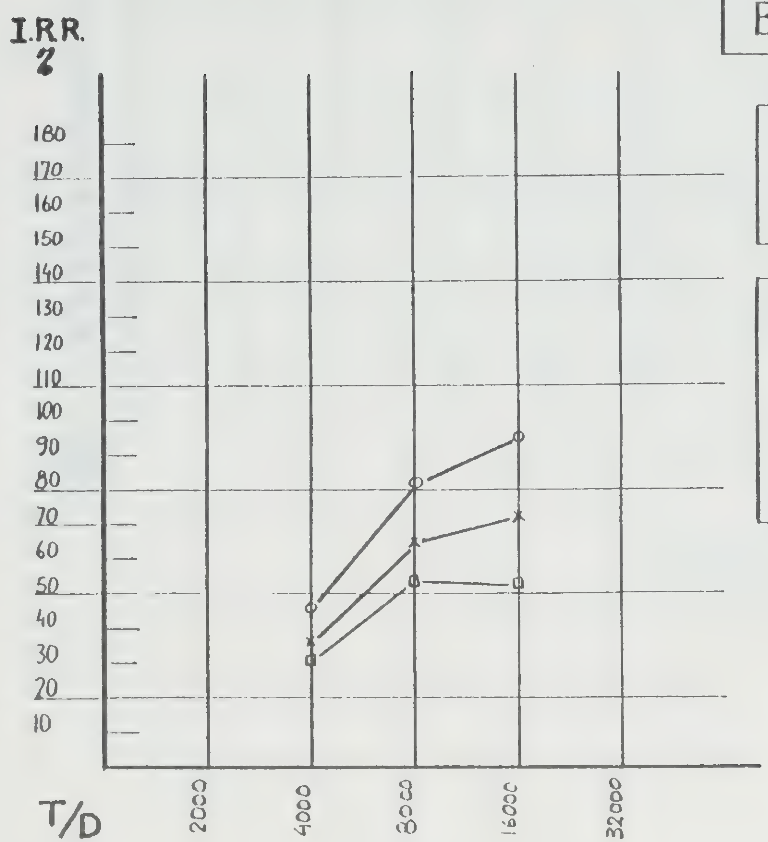
Fig. 135

Fig. 136

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 6

METAL: Uranium
METHOD: OPEN PIT



LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
□ 75 %
× 50 %
○ 25 %

Fig. 136

Fig. 137

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 6

METAL: Gold
METHOD: OPEN PIT

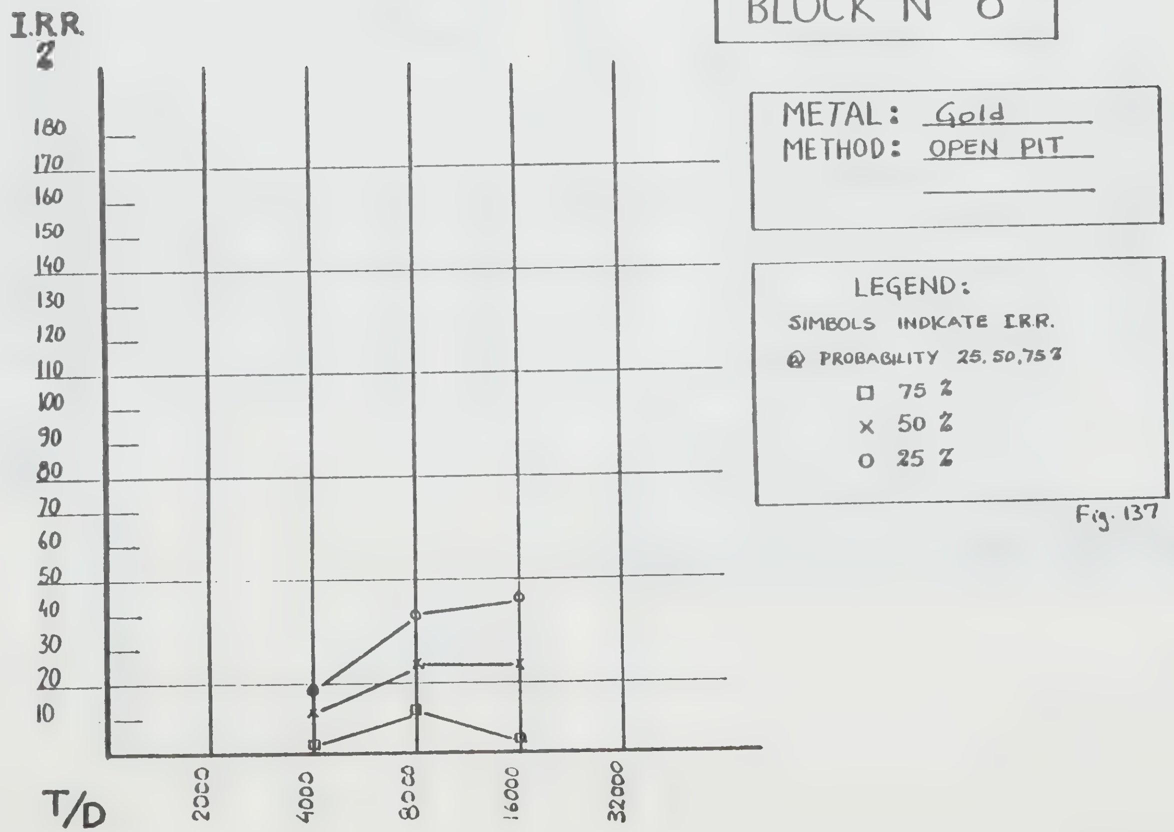


Fig. 137

Fig. 138

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 6

METAL: Silver
METHOD: OPEN PIT

LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
□ 75 %
× 50 %
○ 25 %

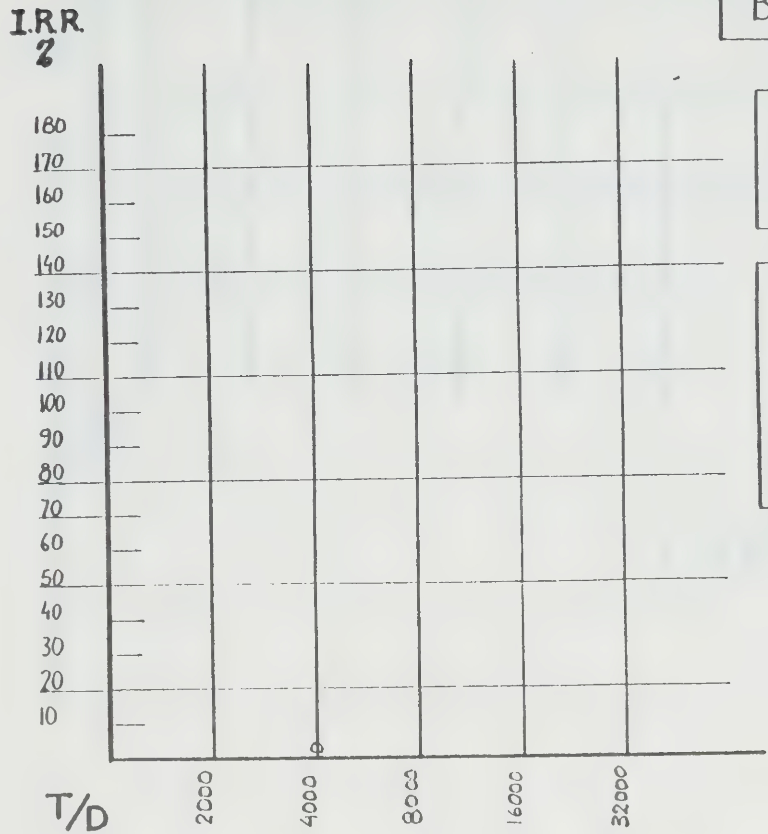


Fig. 138

Fig 1.9

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 6

METAL: Iron
METHOD: OPEN PIT

LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
□ 75 %
x 50 %
o 25 %

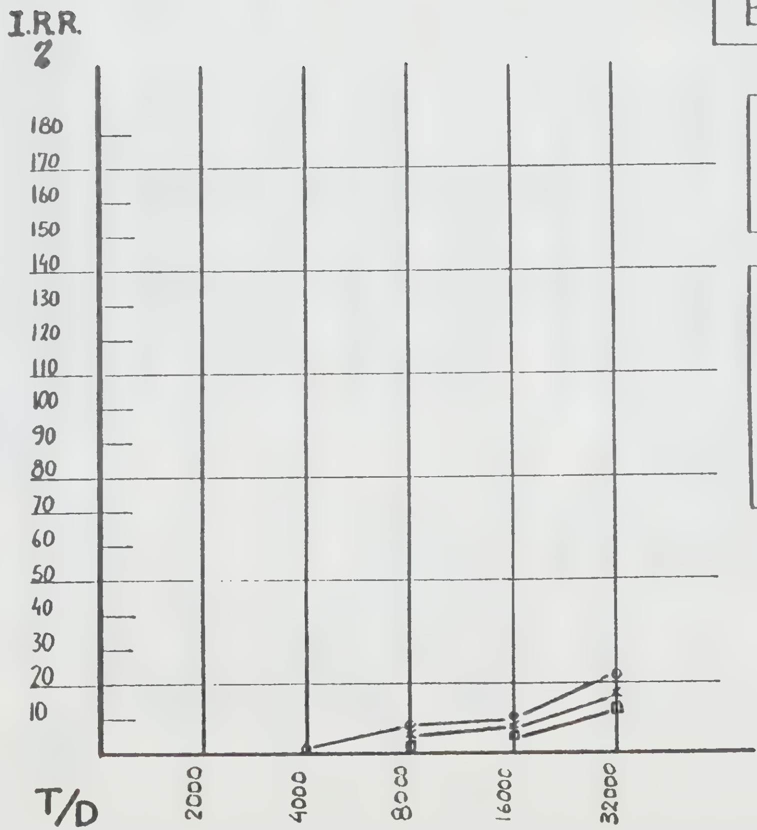


Fig. 139

Fig. 140

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 6

METAL: Li Cb
METHOD: OPEN PIT

LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
□ 75 %
× 50 %
o 25 %

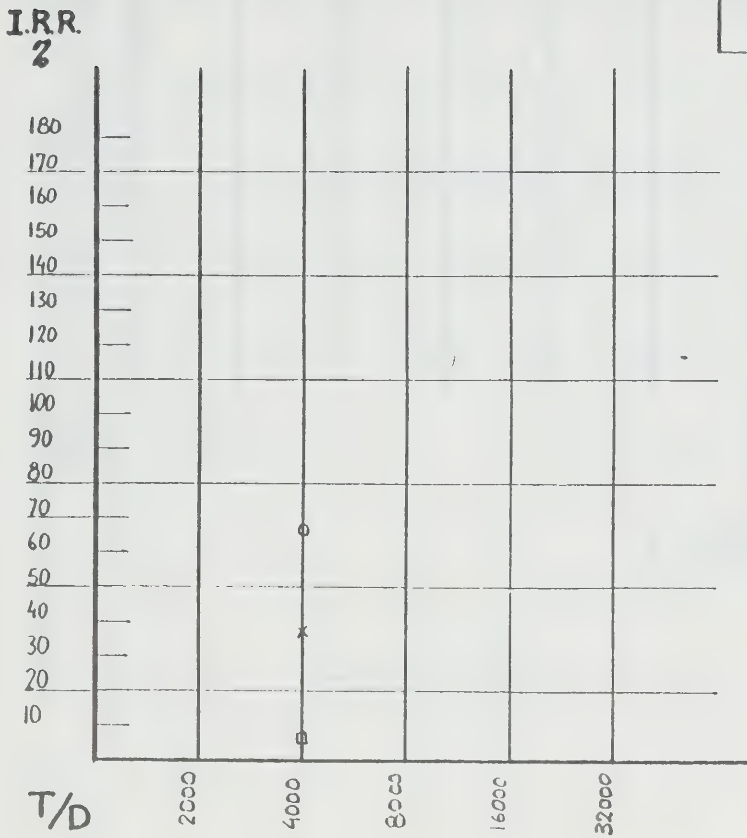


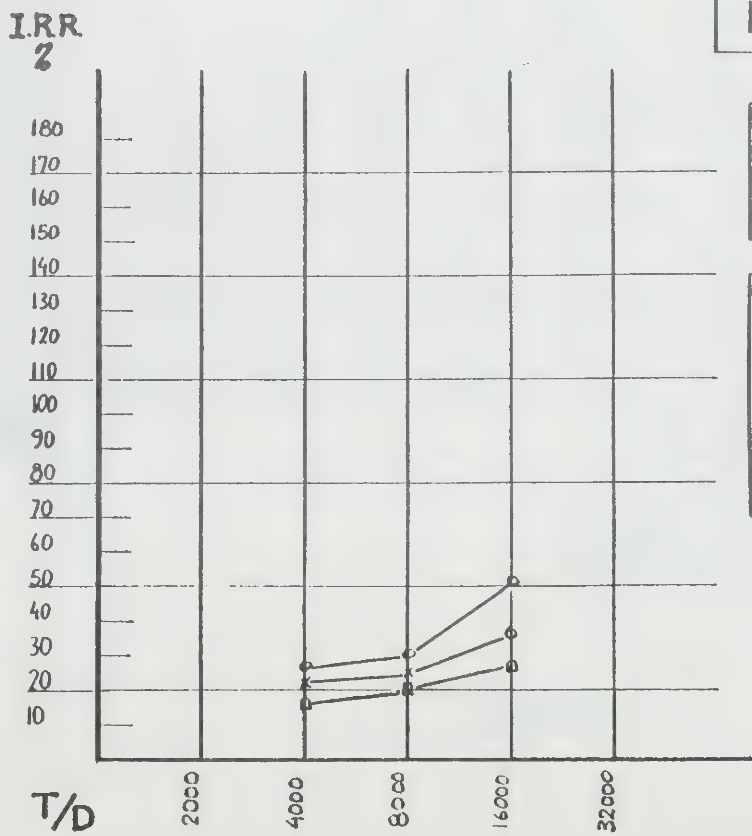
Fig. 140

Fig. 141

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 7

METAL: CuPbZn
METHOD: OPEN PIT



LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
□ 75 %
× 50 %
o 25 %

Fig. 141

Fig. 142

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 7

METAL: NiCu
METHOD: OPEN PIT

LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
□ 75 %
× 50 %
o 25 %

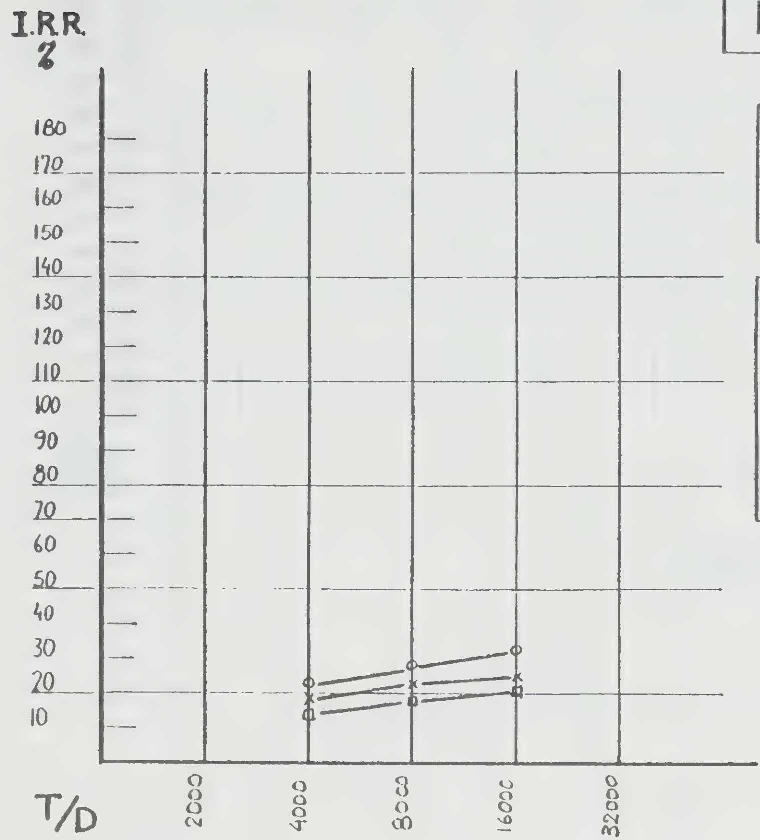


Fig. 142

Fig. 143

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 7

METAL: Uranium
METHOD: OPEN PIT

LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
□ 75 %
x 50 %
o 25 %

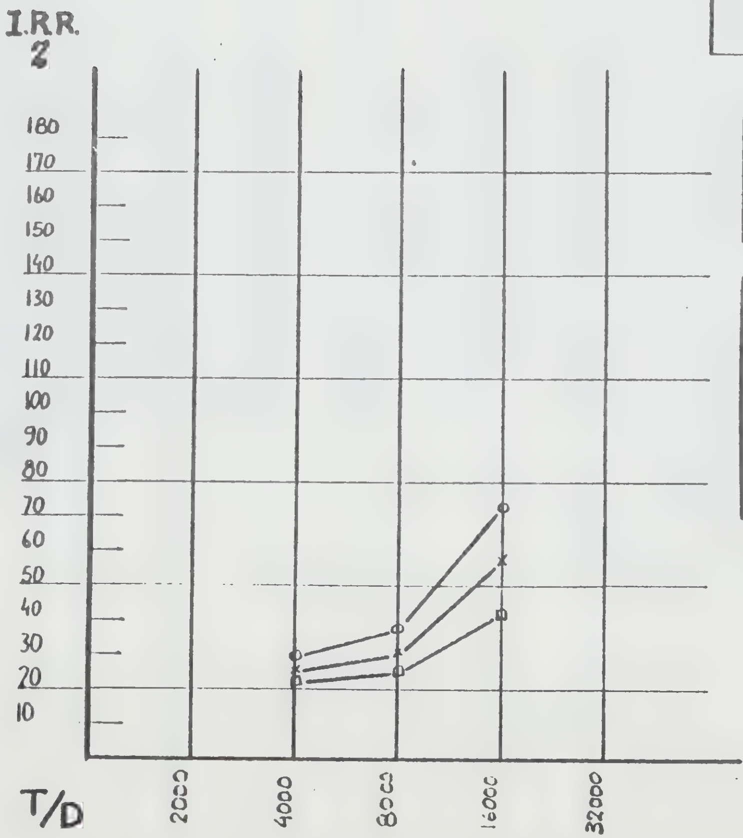


Fig. 143

Fig 144

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 7

METAL: Gold
METHOD: OPEN PIT

LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
□ 75 %
× 50 %
o 25 %

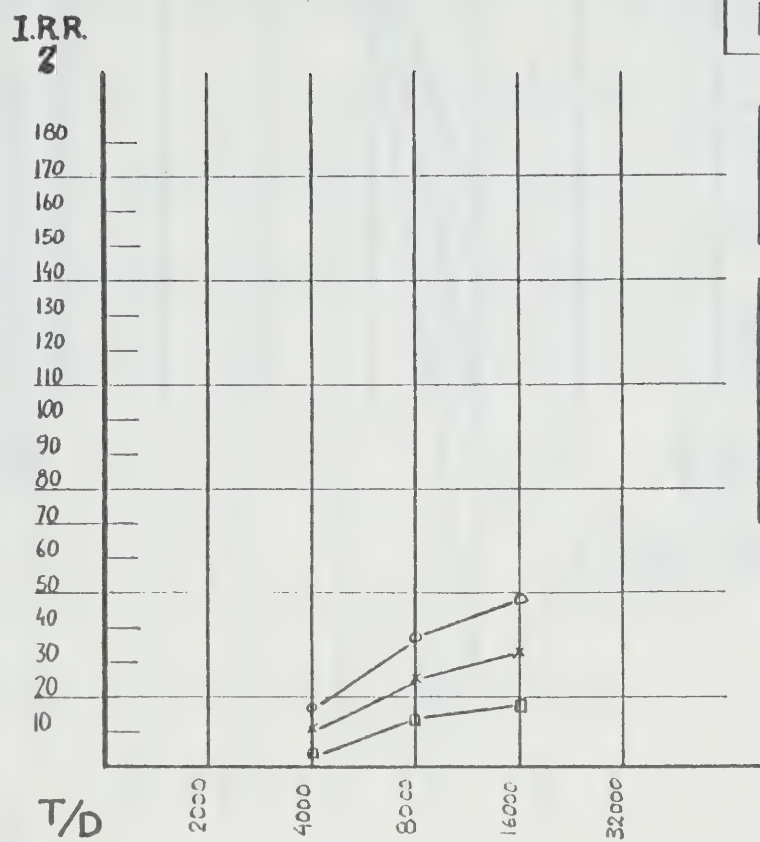


Fig. 144

Fig 145

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 7

METAL: LiCb
METHOD: OPEN PIT

LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
□ 75 %
× 50 %
o 25 %

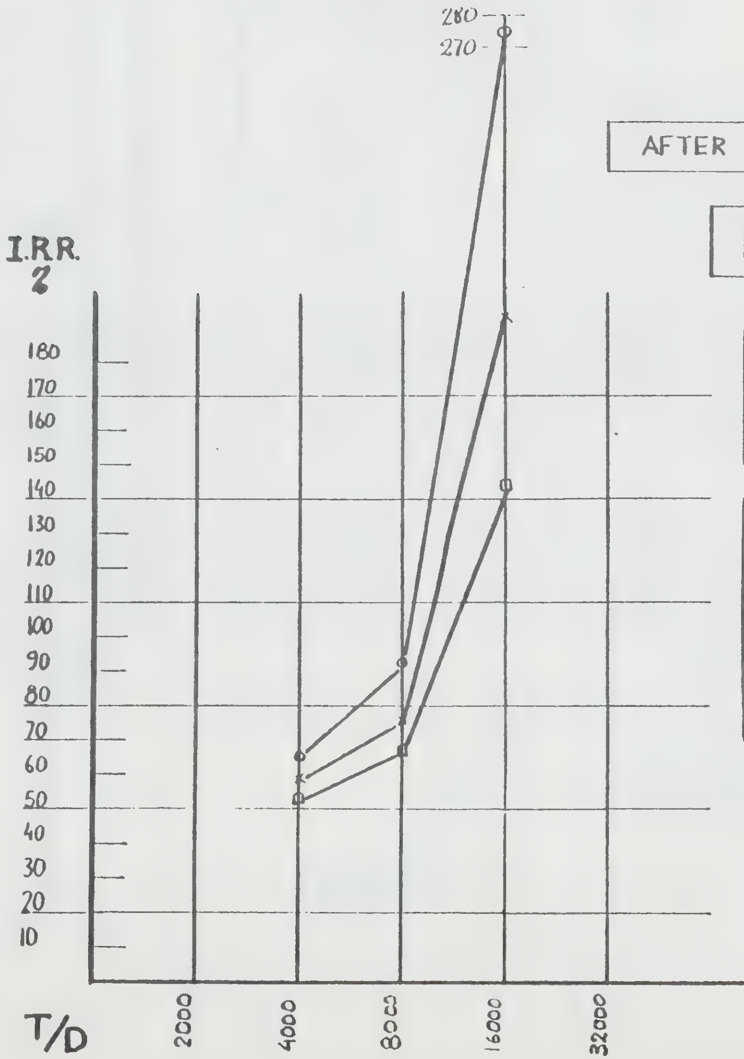


Fig. 145

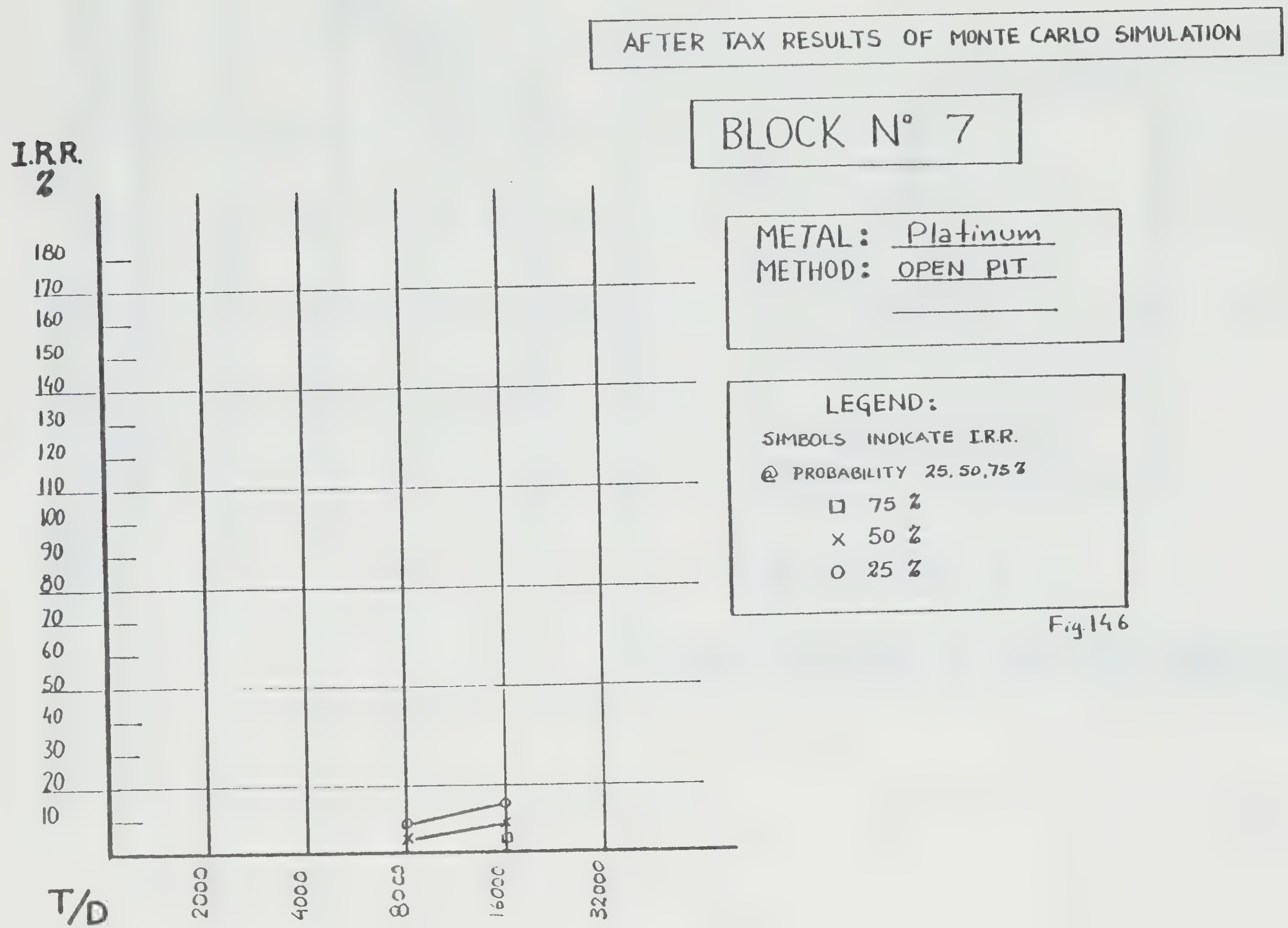

AFTER TAX RESULTS OF MONTE CARLO SIMULATION
BLOCK N° 7
METAL: Platinum
METHOD: OPEN PIT
LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
□ 75 %
× 50 %
○ 25 %
I.R.R. %
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
T/D
2000
4000
8000
16000
32000

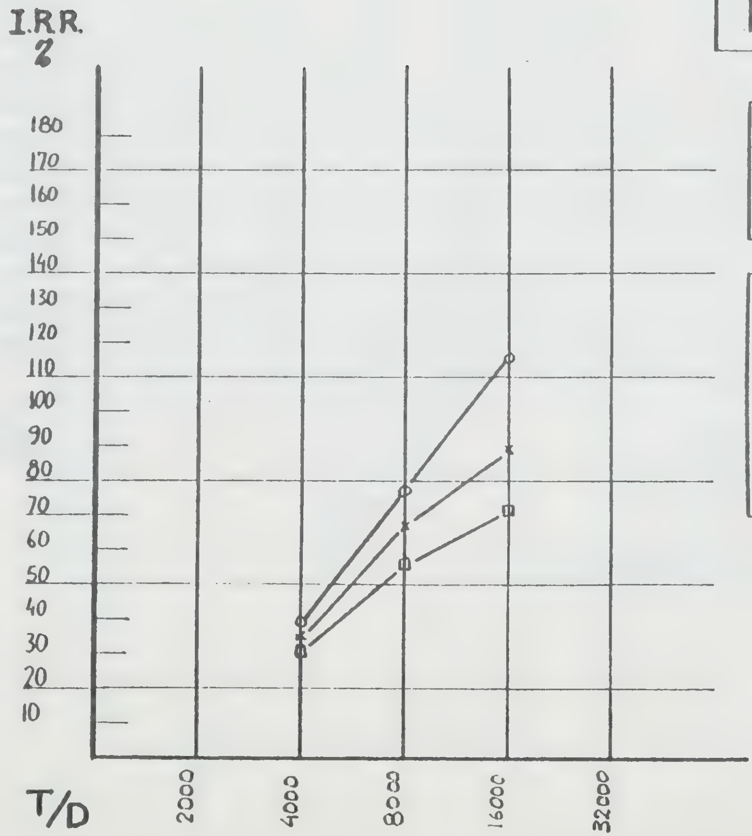
Fig. 146

Fig. 147

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 8

METAL: Cu Pb Zn
METHOD: OPEN PIT



LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
□ 75 %
× 50 %
o 25 %

Fig. 147

Fig. 148

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 8

METAL: Gold
METHOD: OPEN PIT

LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
□ 75 %
× 50 %
○ 25 %

Fig. 148

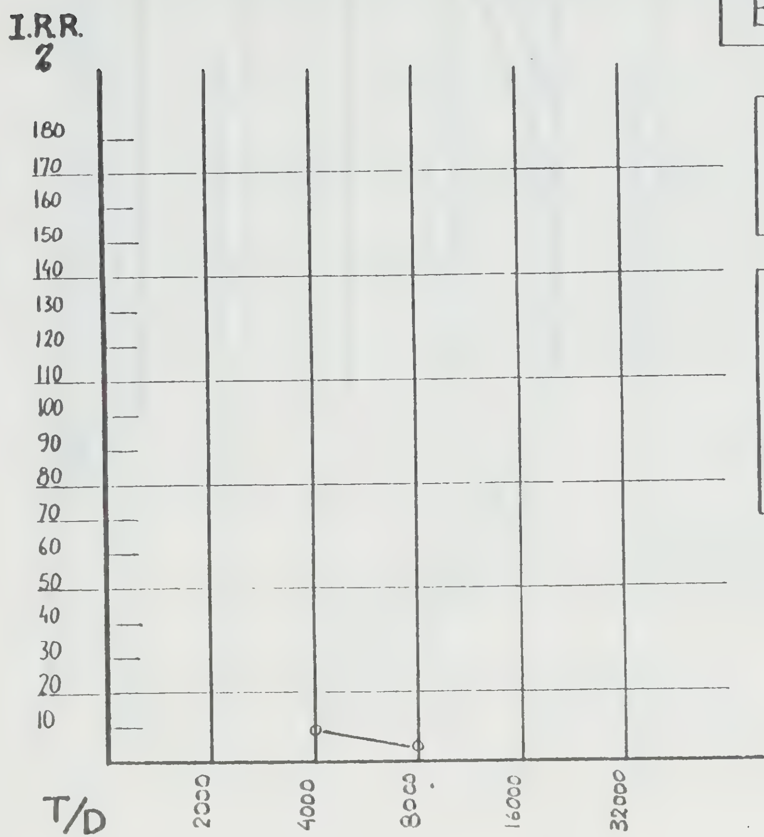


Fig. 149

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 9

METAL: Cu Pb Zn
METHOD: OPEN PIT

LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
□ 75 %
× 50 %
o 25 %

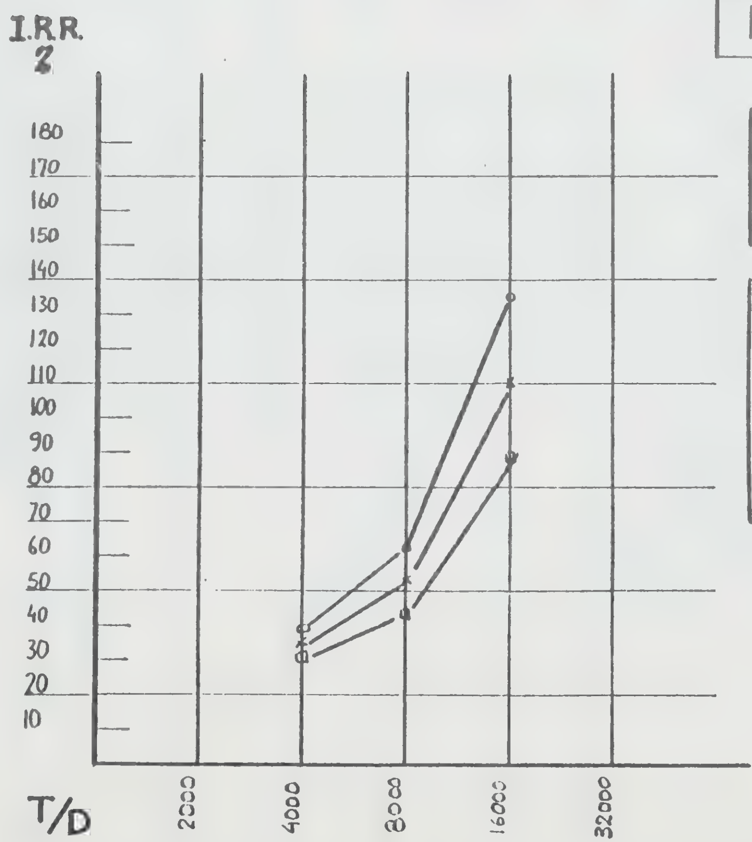


Fig. 149

Fig. 150

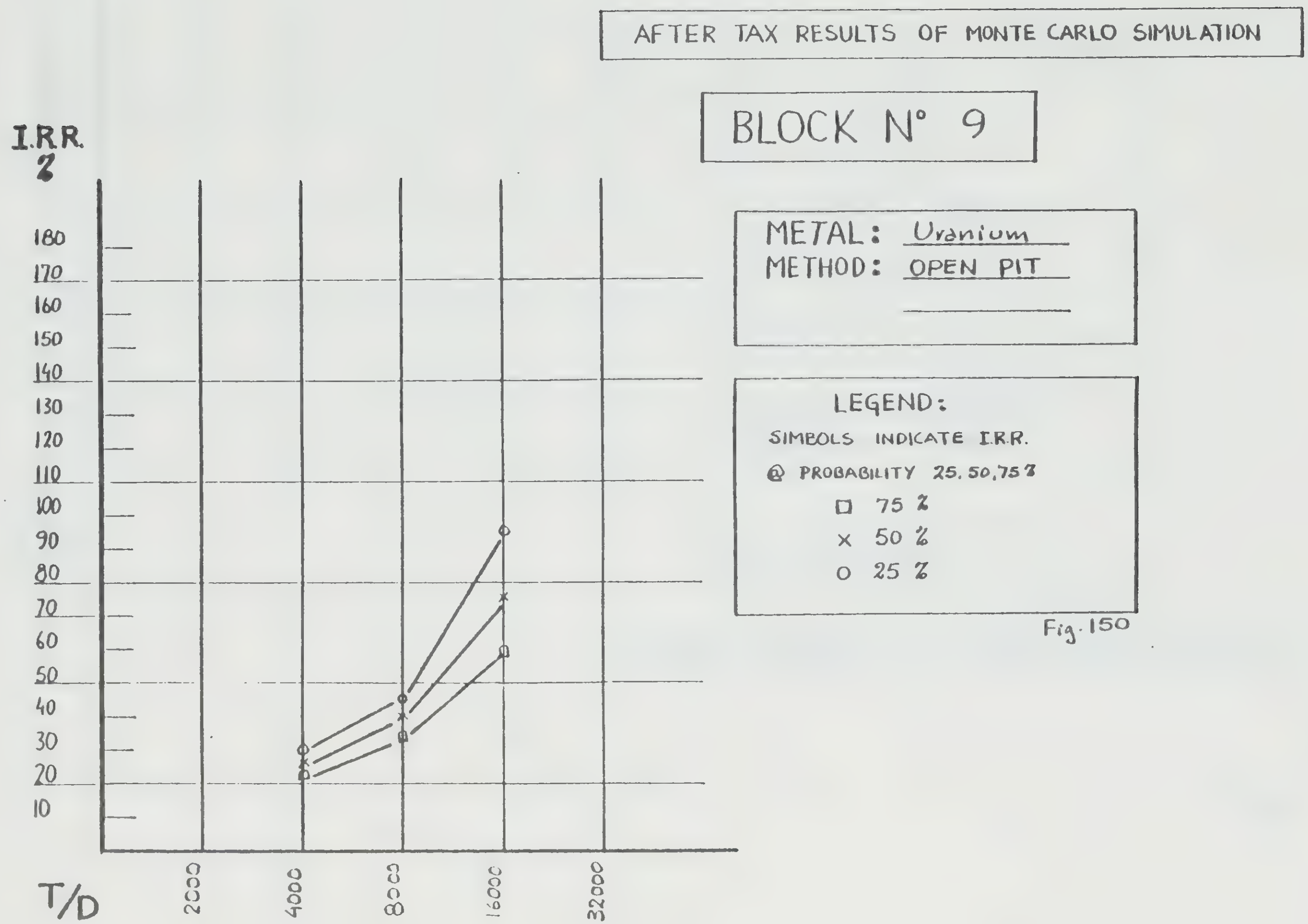


Fig. 150

Fig. 151

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 9

METAL: Gold
METHOD: OPEN PIT

LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
□ 75 %
× 50 %
o 25 %

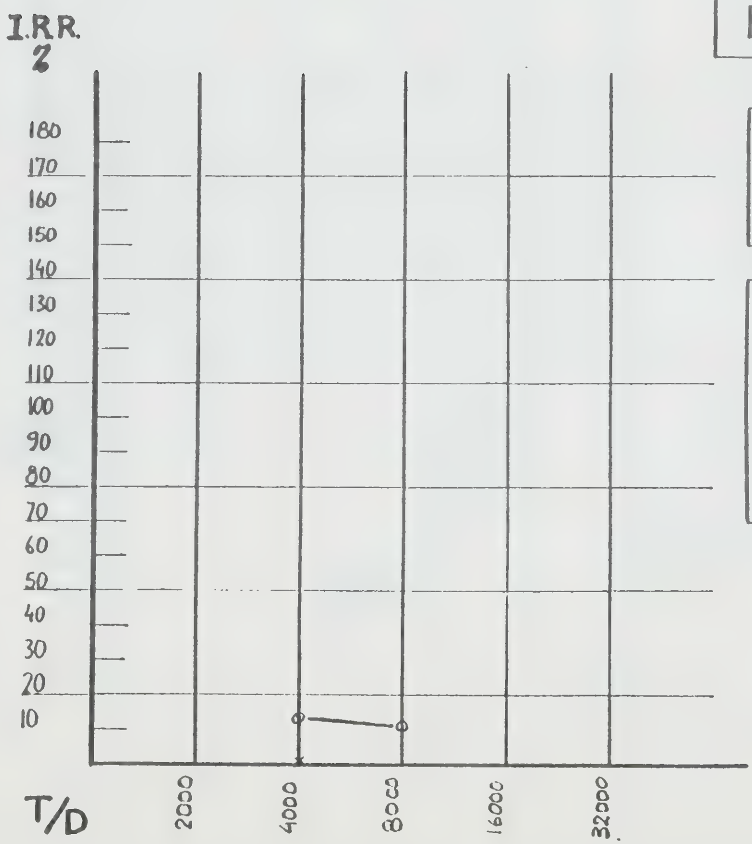


Fig. 151

Fig. 152

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 9

METAL: Silver
METHOD: OPEN PIT

LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
□ 75 %
× 50 %
○ 25 %

Fig. 152

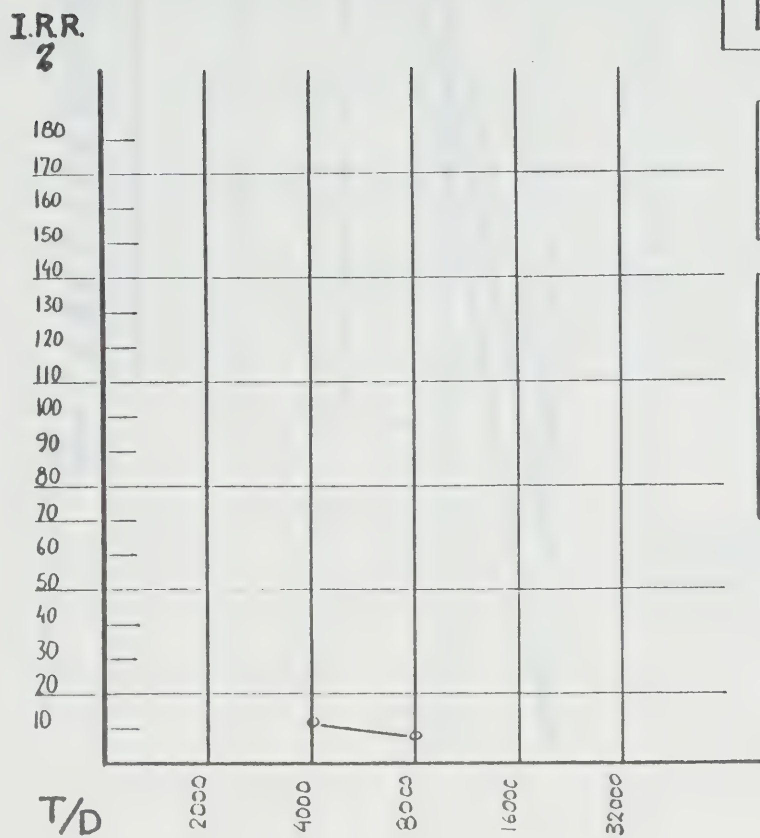


Fig. 153

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 9

METAL: LiCb
METHOD: OPEN PIT

LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
□ 75 %
× 50 %
o 25 %

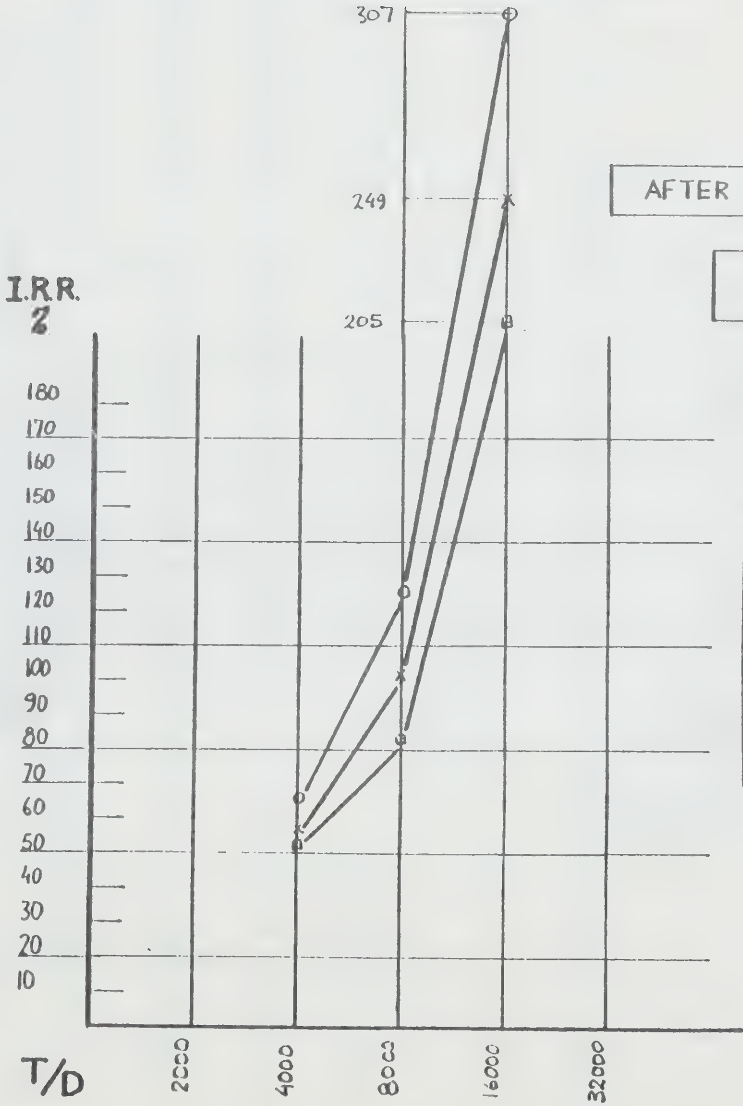


Fig. 153

Fig. 154

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 10

METAL: Copper
METHOD: OPEN PIT

LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
□ 75 %
× 50 %
○ 25 %

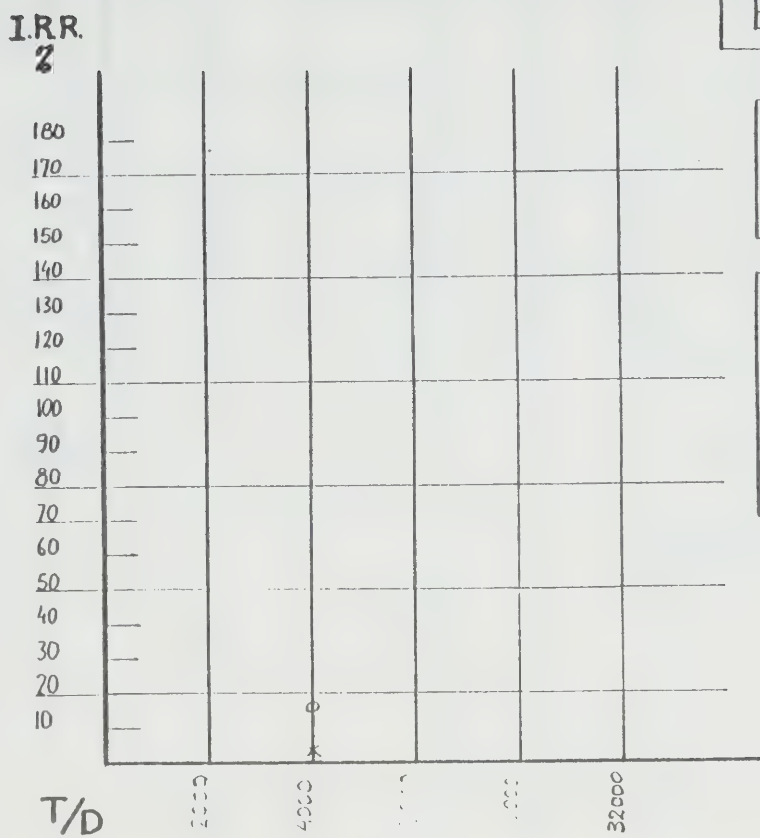


Fig. 154

Fig. 155

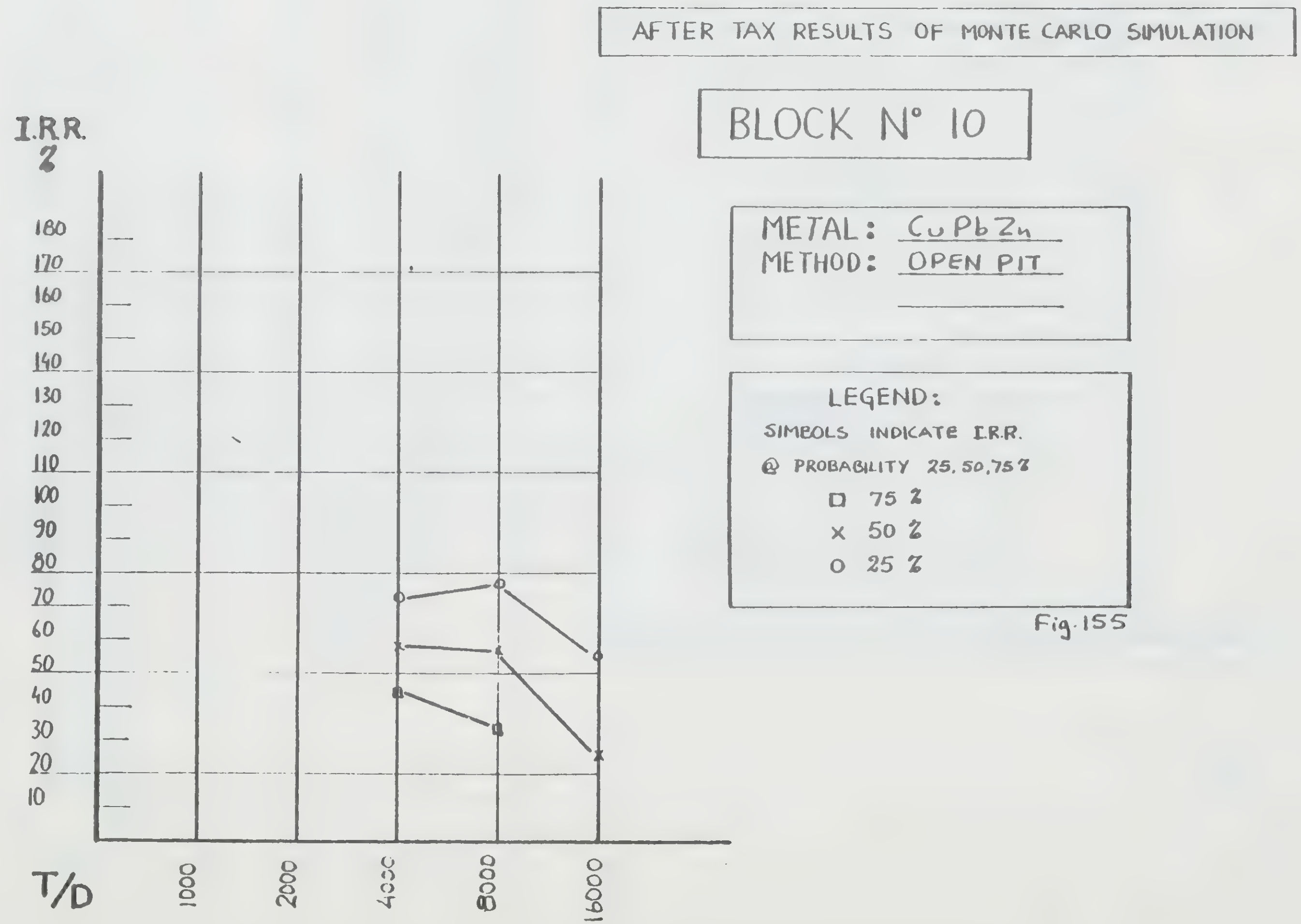


Fig. 155

Fig. 156

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

BLOCK N° 10

METAL: PbZn
METHOD: ______

LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
□ 75 %
× 50 %
○ 25 %

Fig. 156

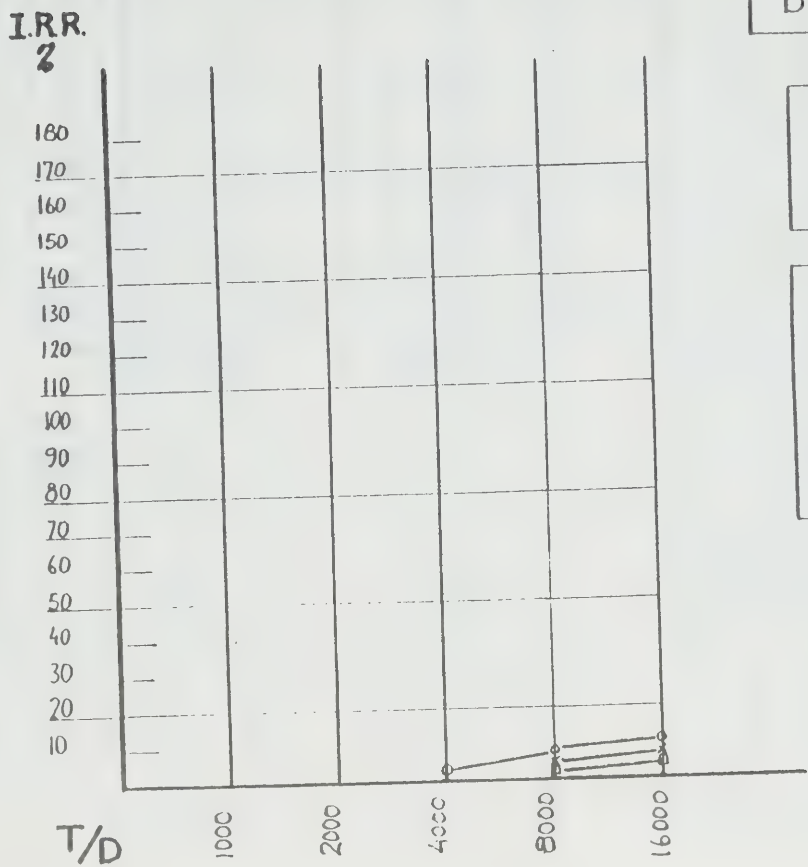
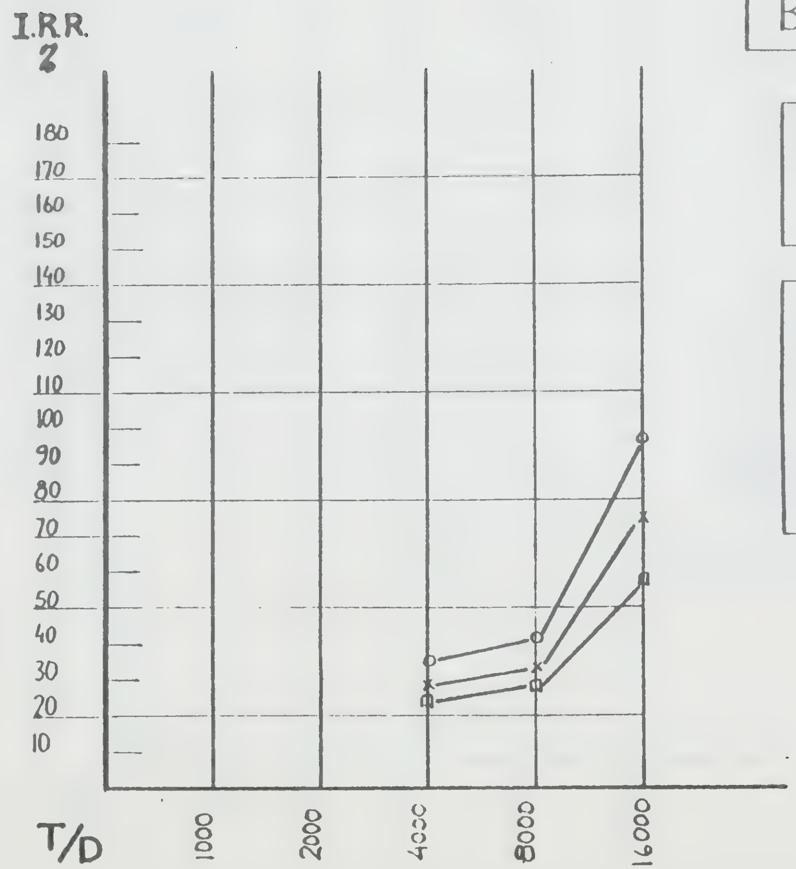


Fig. 157

AFTER TAX RESULTS OF MONTE CARLO SIMULATION

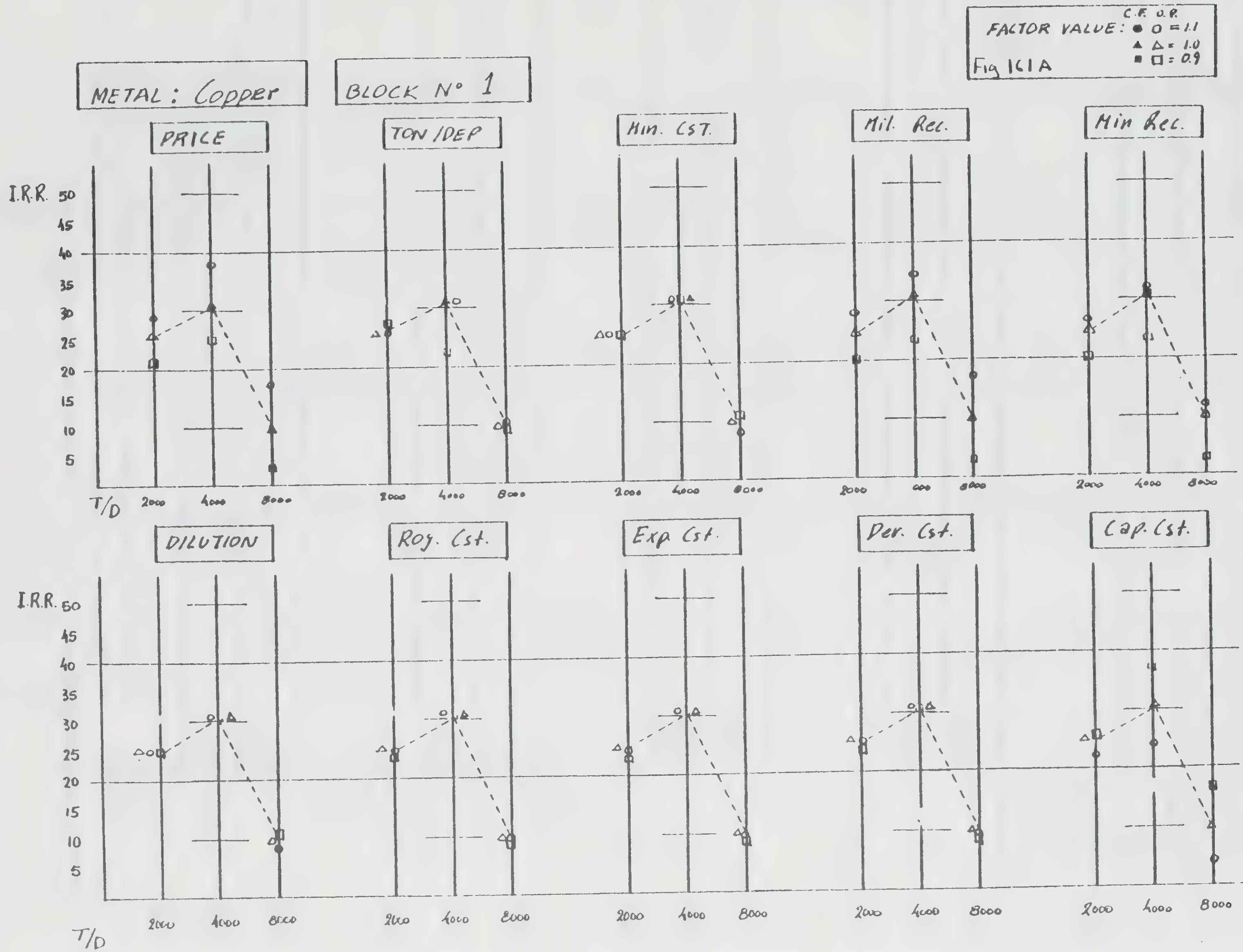
BLOCK N° 10

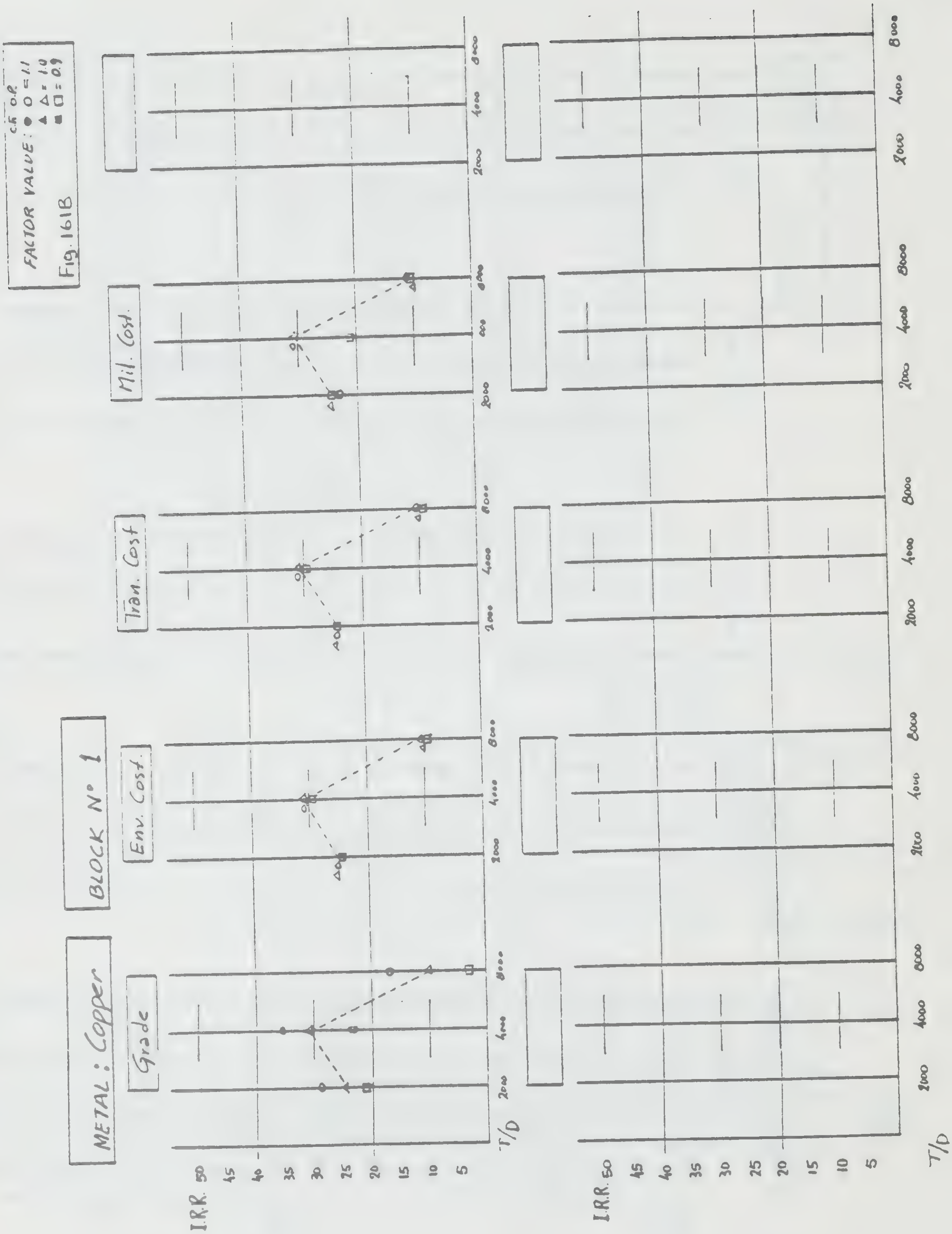
METAL: Uranium
METHOD:

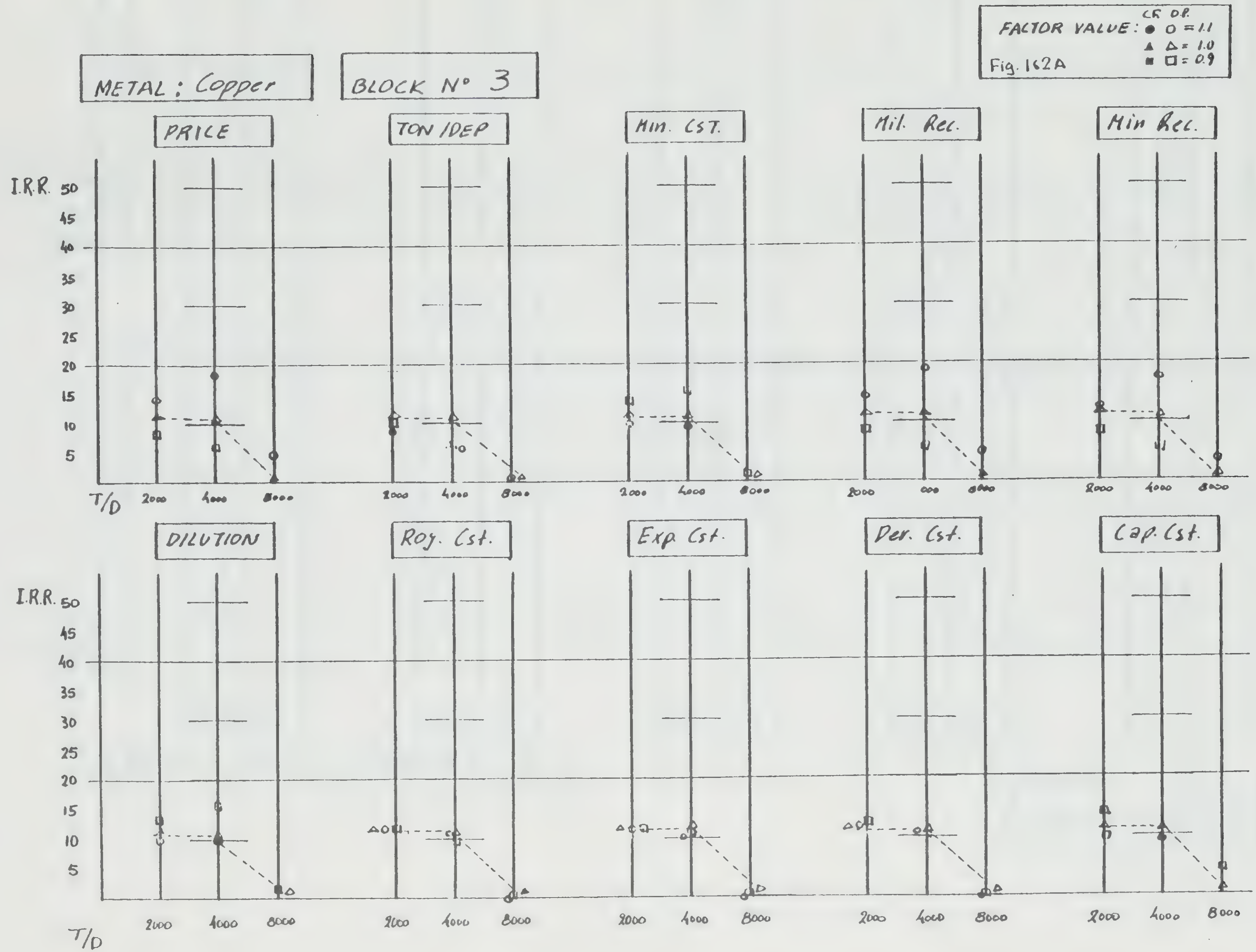


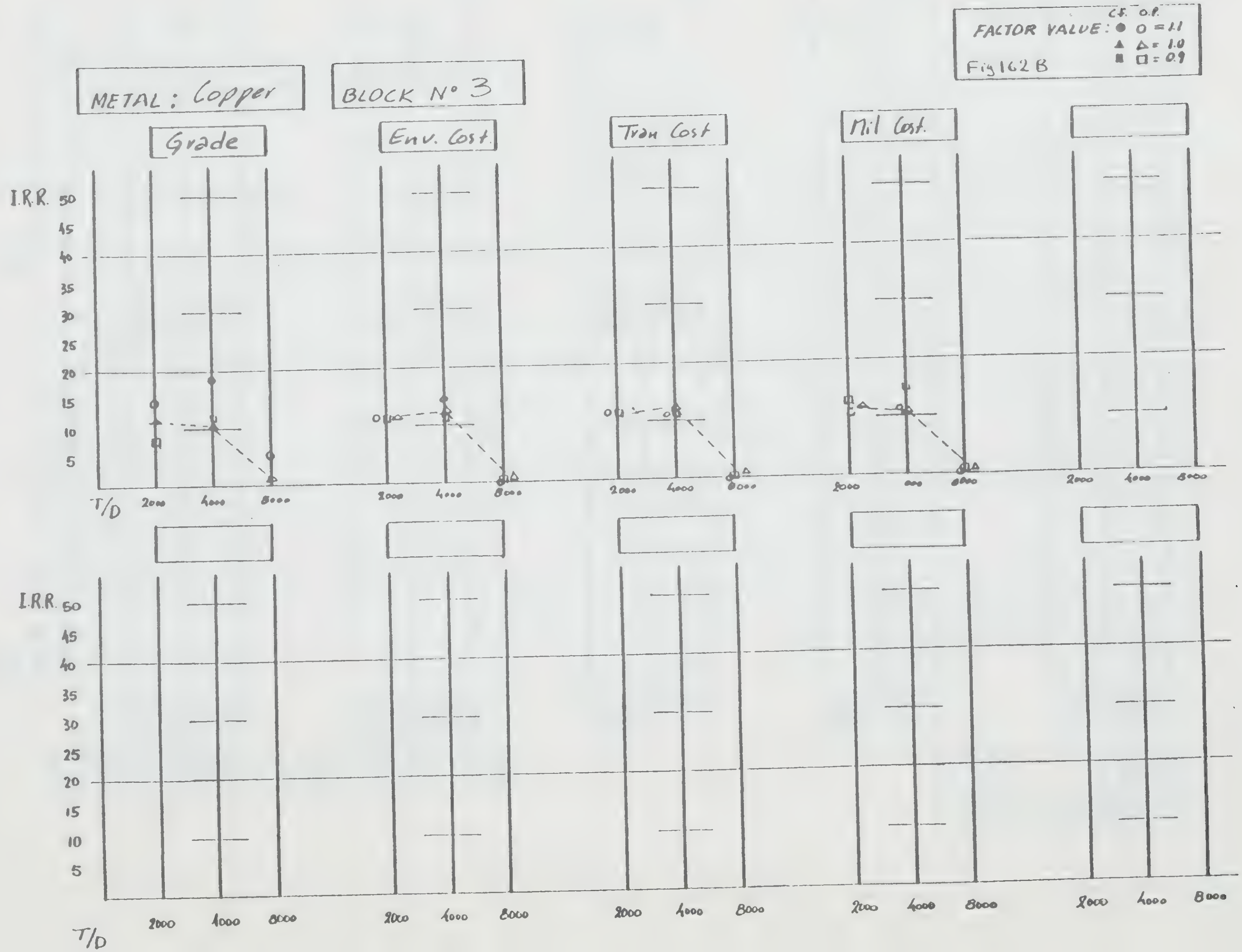
LEGEND:
SIMBOLS INDICATE I.R.R.
@ PROBABILITY 25, 50, 75 %
□ 75 %
× 50 %
o 25 %

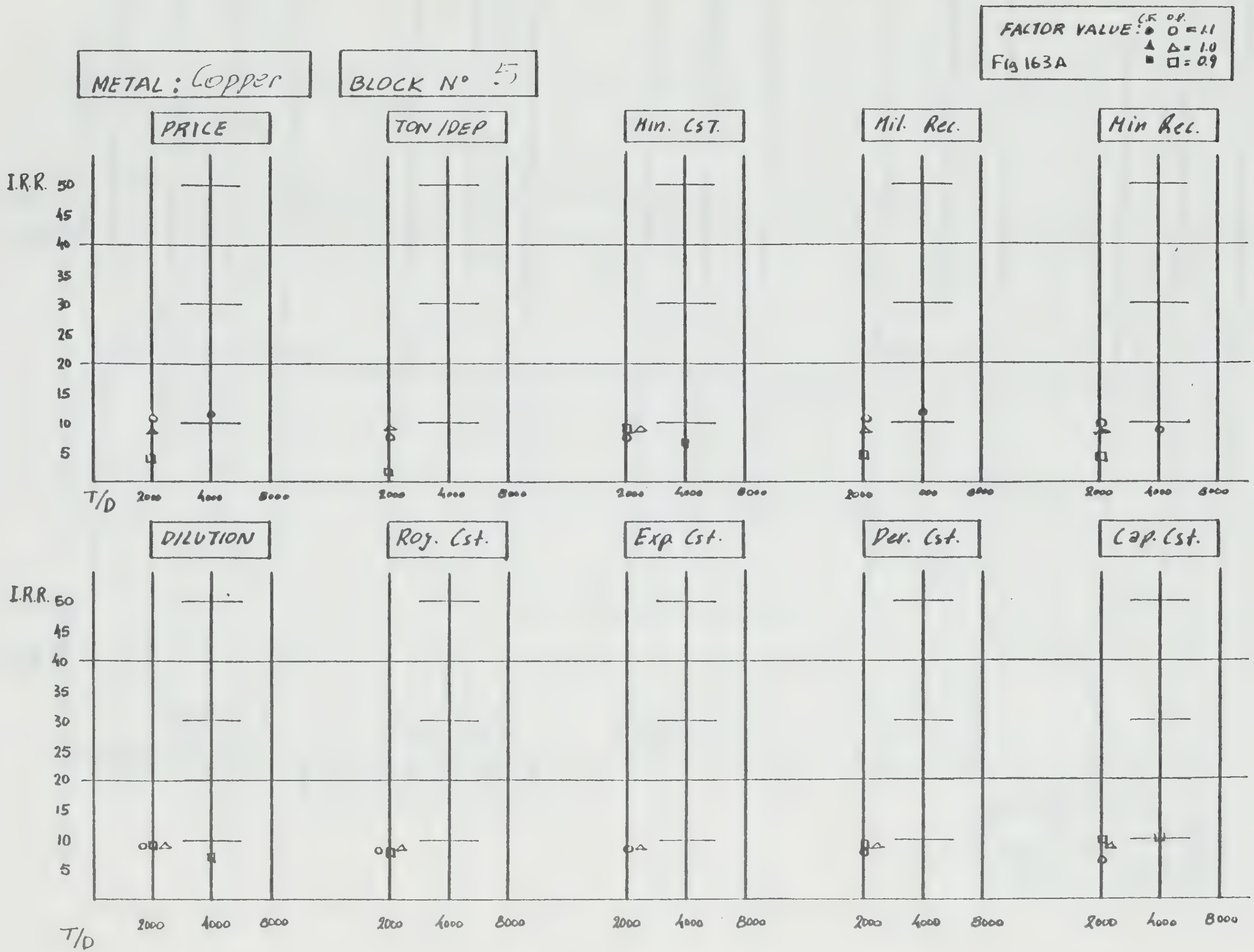
Fig. 157

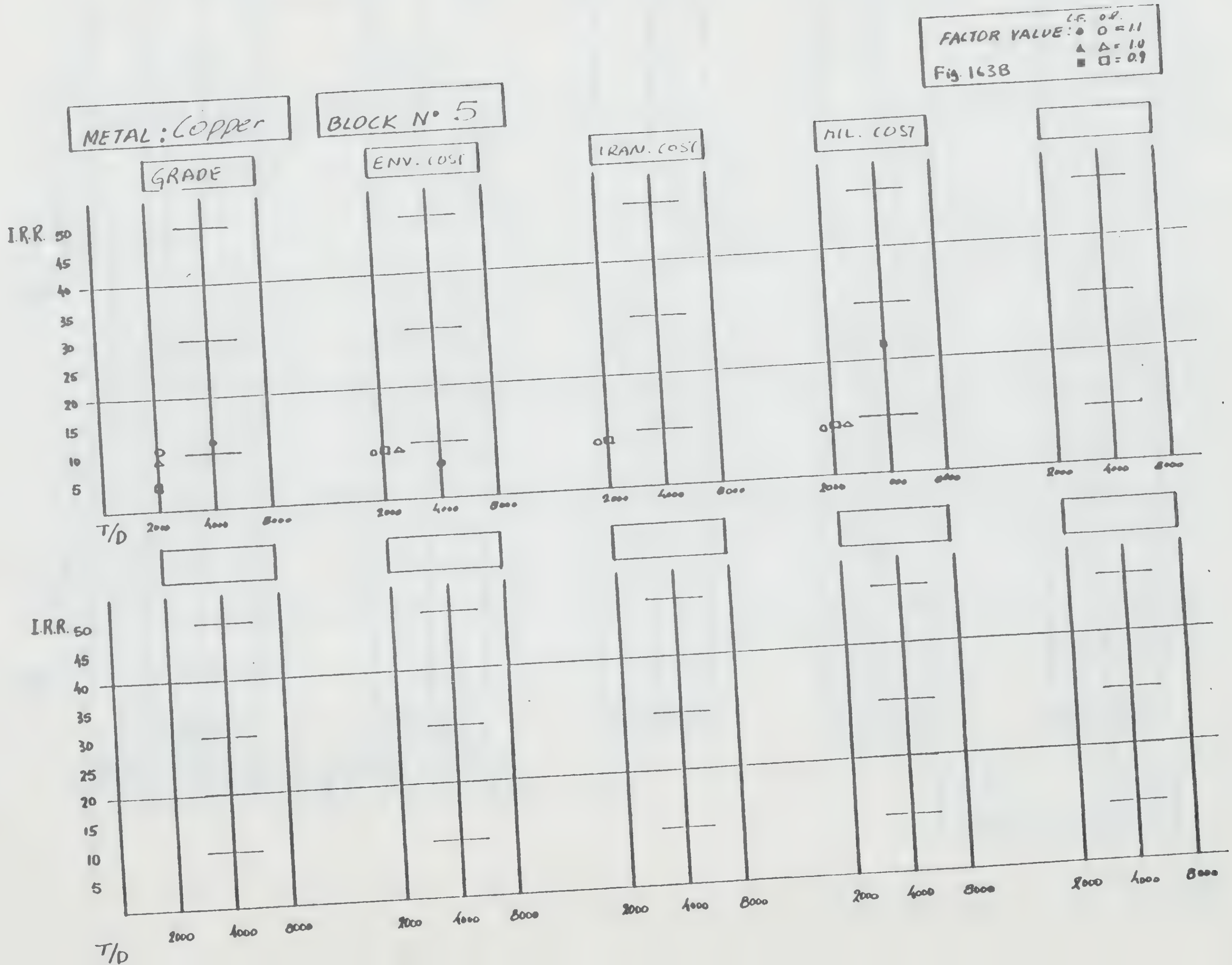

METAL : Copper
BLOCK N° 1
FACTOR VALUE: C.F. O.R. ● ○ = 1.1 ▲ △ = 1.0 ■ □ = 0.9
Fig 161 A
PRICE
TON/DEP
Min. CST.
Mil. Rec.
Min Rec.
DILUTION
Roy. Cst.
Exp Cst.
Der. Cst.
Cap. Cst.
I.R.R.
50
45
40
35
30
25
20
15
10
5
T/D
2000
4000
8000


METAL : Copper
BLOCK N° 1
FACTOR VALUE: cR O.P.
● ○ = 1.1
▲ △ = 1.0
■ □ = 0.9
Fig. 161B
Grade
Env. Cost
Tran. Cost
Mil. Cost
I.R.R.
50 45 40 35 30 25 20 15 10 5
T/D
2000 4000 8000

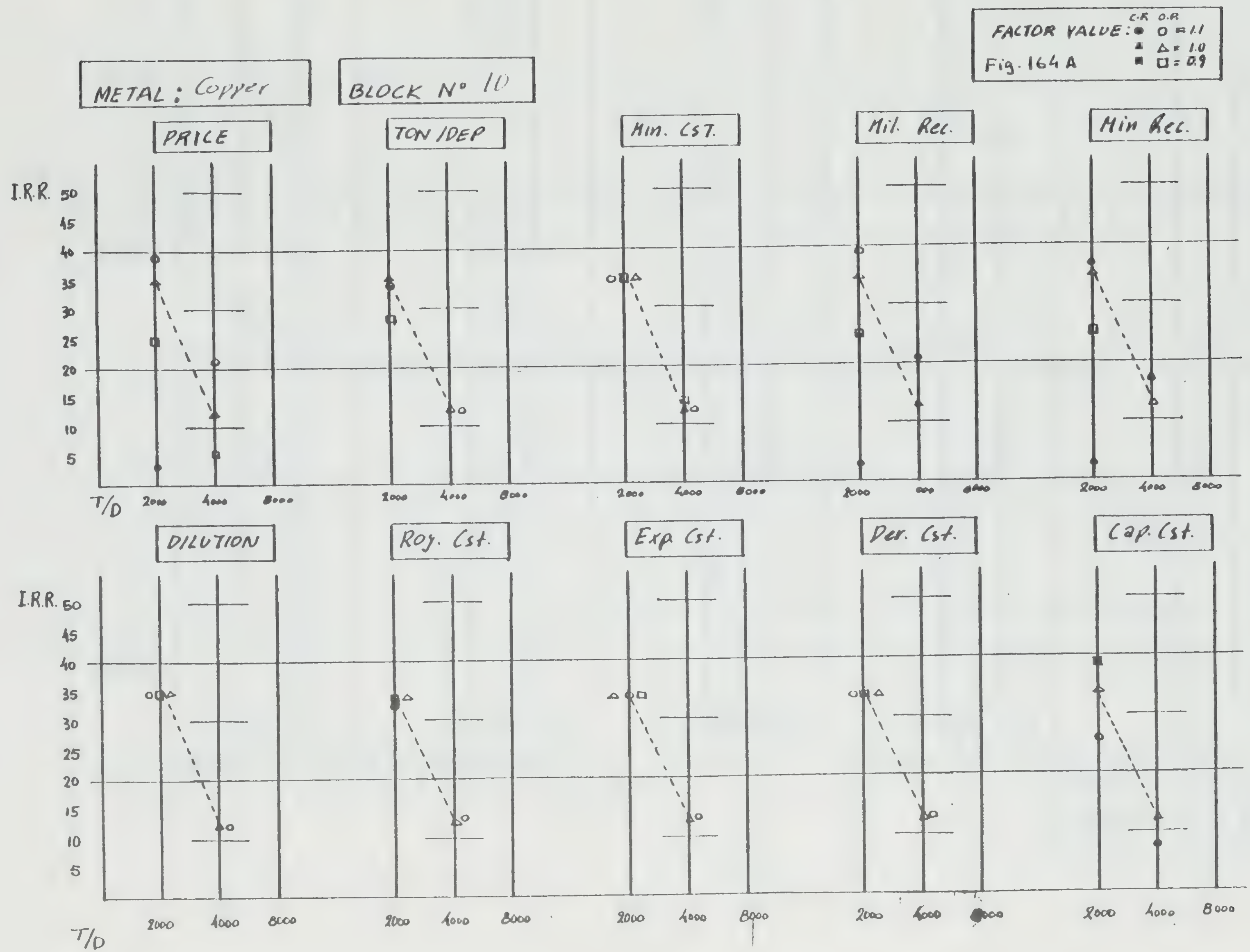

METAL : Copper
BLOCK N° 3
FACTOR VALUE : CF. OP. ● ○ = 1.1 ▲ △ = 1.0 ■ □ = 0.9
Fig. 162A
PRICE
TON/DEP
Min. CST.
Mil. Rec.
Min Rec.
DILUTION
Roy. Cst.
Exp. Cst.
Der. Cst.
Cap. Cst.
I.R.R.
50
45
40
35
30
25
20
15
10
5
T/D
2000
4000
8000


FACTOR VALUE: C.F. O.P. ● ○ = 1.1 ▲ △ = 1.0 ■ □ = 0.9
Fig 16.2 B
METAL : Copper
BLOCK N° 3
Grade
Env. Cost
Tran Cost
Mil Cost.
I.R.R.
50
45
40
35
30
25
20
15
10
5
T/D
2000
4000
8000

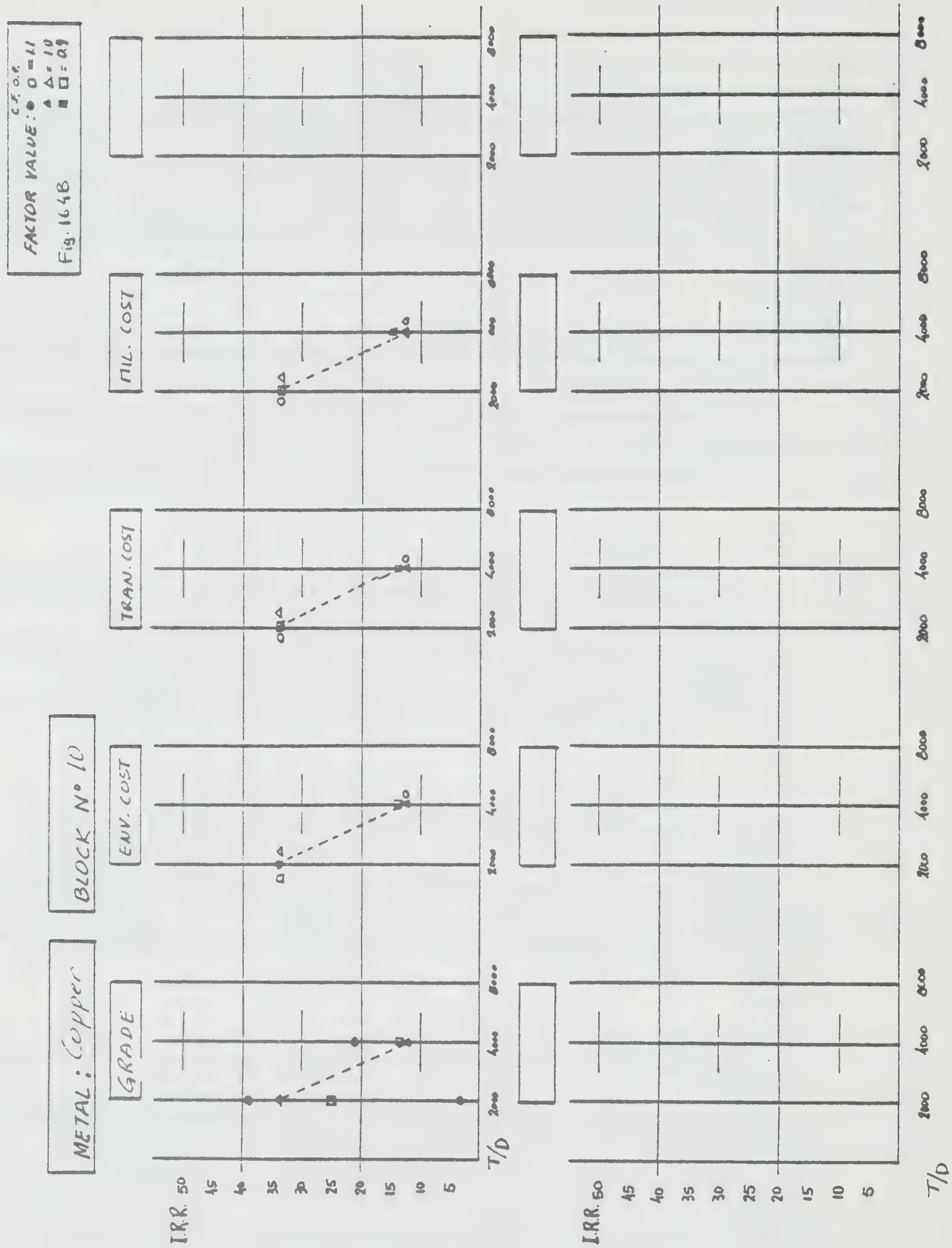

METAL : Copper
BLOCK N° 5
FACTOR VALUE: C.F. O.F. ● ○ = 1.1 ▲ △ = 1.0 ■ □ = 0.9
Fig 163A
PRICE
TON/DEP
Min. CST.
Mil. Rec.
Min Rec.
DILUTION
Roy. Cst.
Exp Cst.
Per. Cst.
Cap. Cst.
I.R.R.
T/D
50 45 40 35 30 25 20 15 10 5
2000 4000 8000



FACTOR VALUE: C.F. O.P.
● ○ = 1.1
▲ △ = 1.0
■ □ = 0.9
Fig. 163B
METAL: Copper
BLOCK N° 5
GRADE
ENV. COST
TRAN. COST
MIL. COST
I.R.R.
50
45
40
35
30
25
20
15
10
5
T/D
2000
4000
8000



FACTOR VALUE: C.R. O.R. ● ○ = 1.1 ▲ △ = 1.0 ■ □ = 0.9
Fig. 164 A
METAL : Copper
BLOCK N° 10
PRICE
TON / DEP
Min. CST.
Mil. Rec.
Min Rec.
DILUTION
Roy. Cst.
Exp Cst.
Dev. Cst.
Cap. Cst.
I.R.R.
50
45
40
35
30
25
20
15
10
5
T/D
2000
4000
8000


METAL : Copper
BLOCK N° 10
FACTOR VALUE:
C.F.O.R.
● O = 1.1
▲ Δ = 1.0
■ □ = 0.9
Fig. 164B
GRADE
ENV. COST
TRAN. COST
MIL. COST
I.R.R.
T/D
50 45 40 35 30 25 20 15 10 5
2000 4000 8000

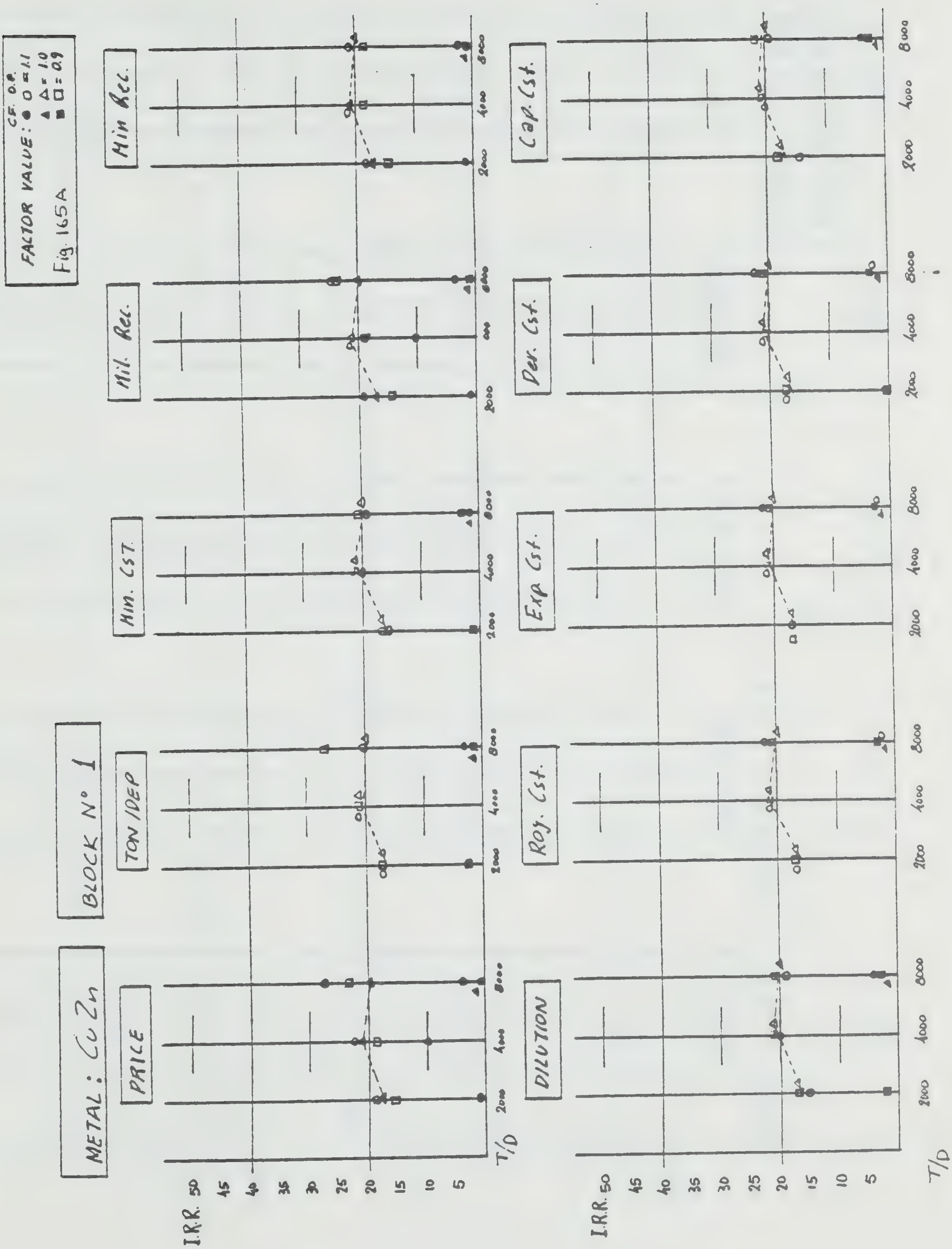
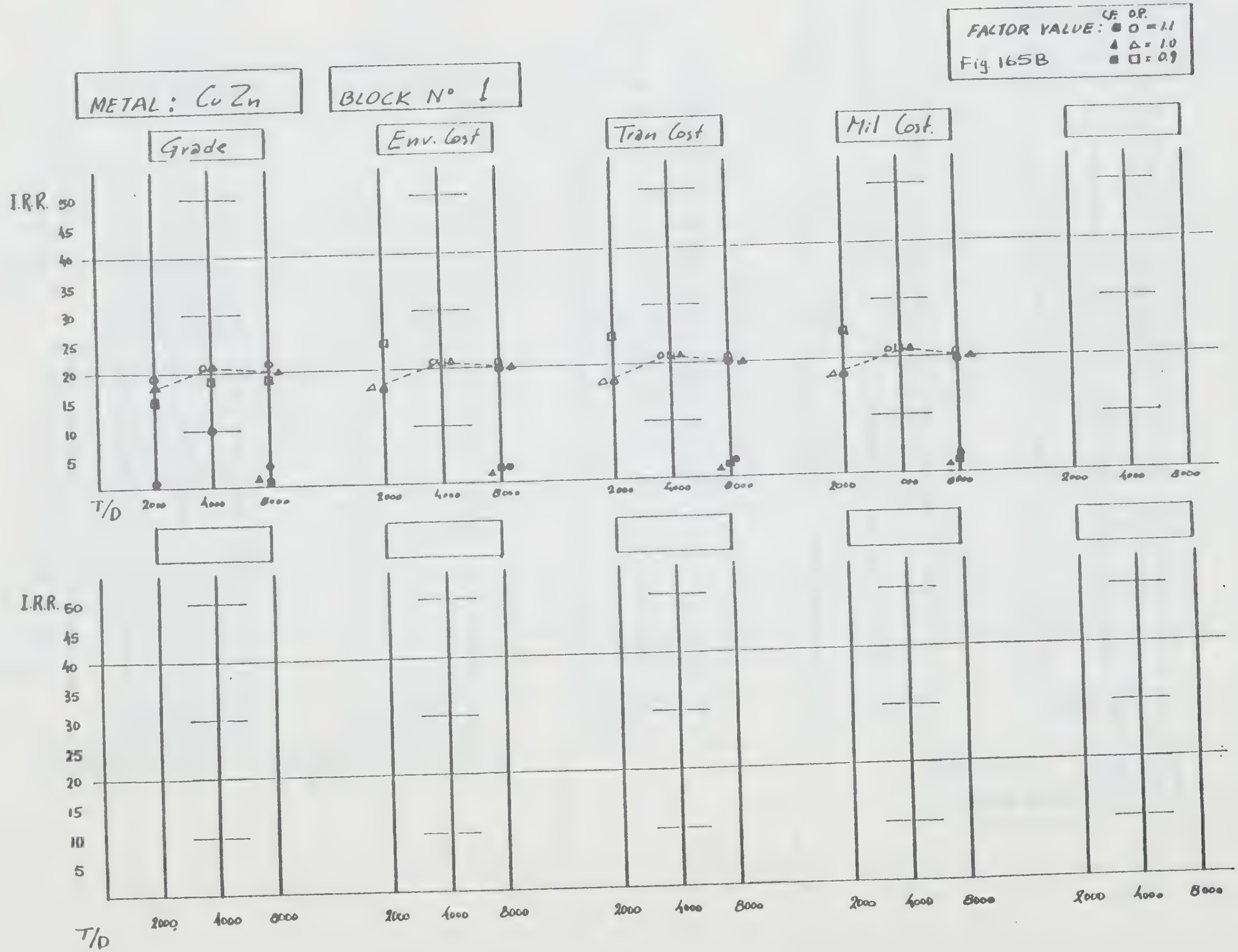
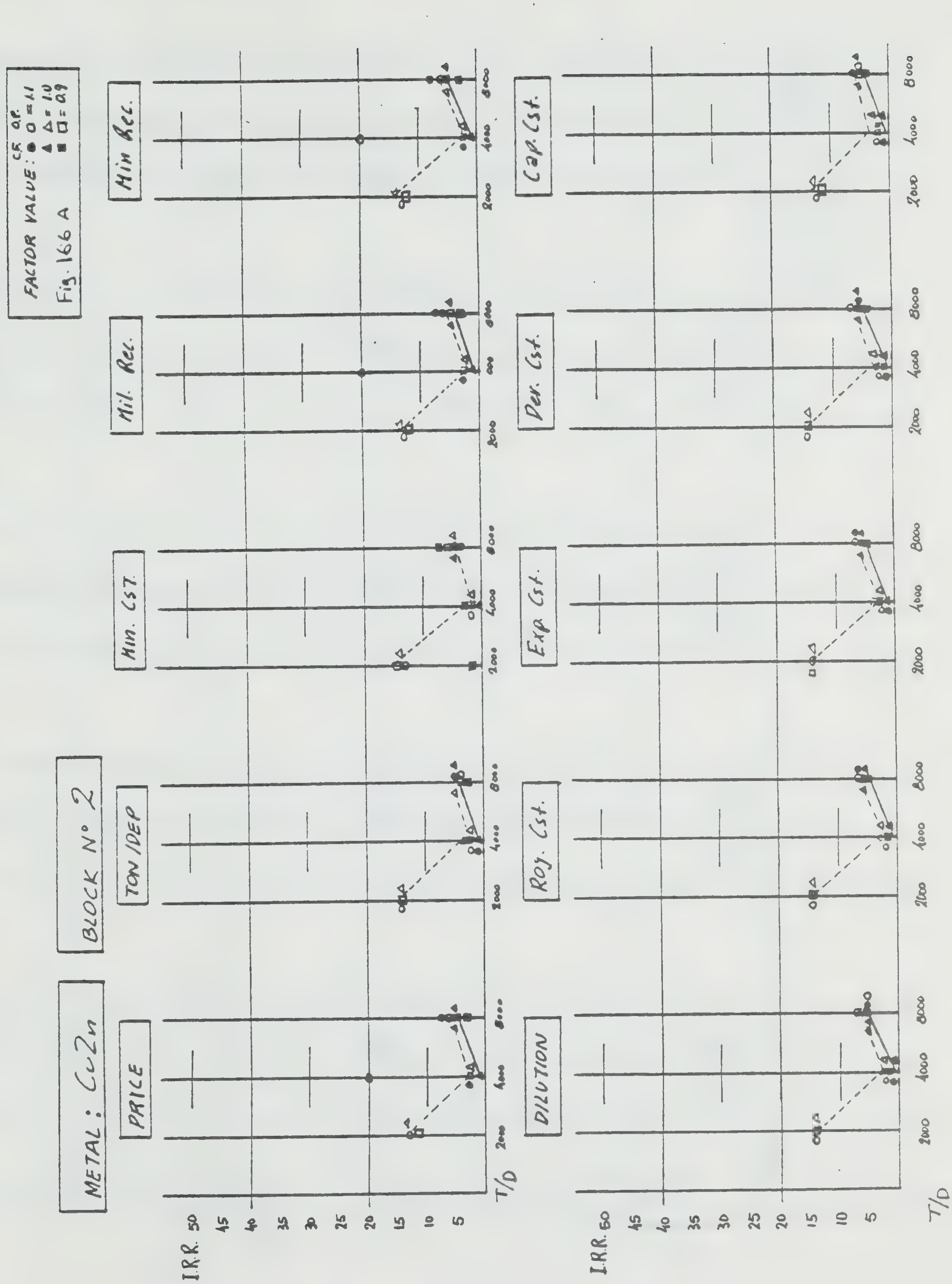
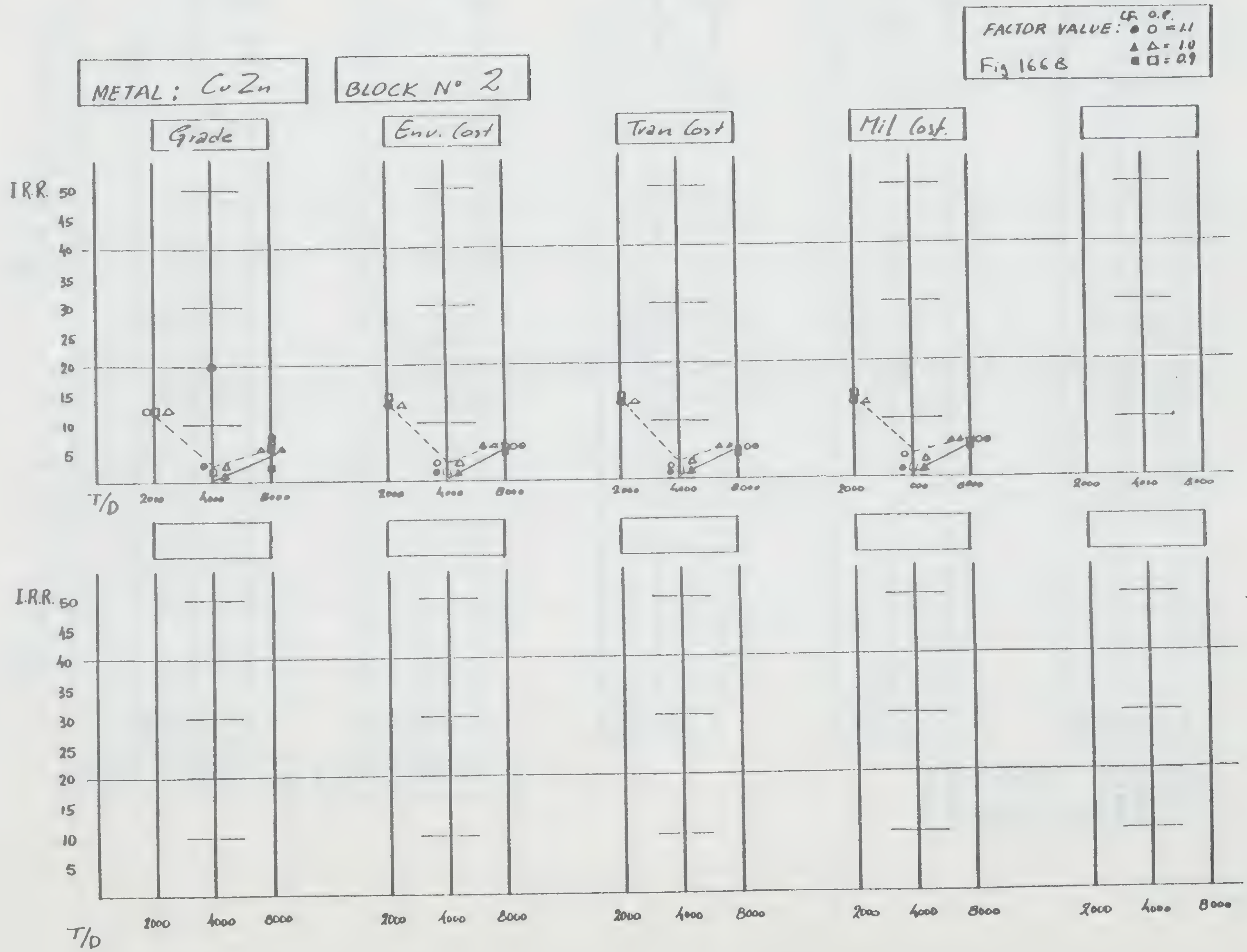
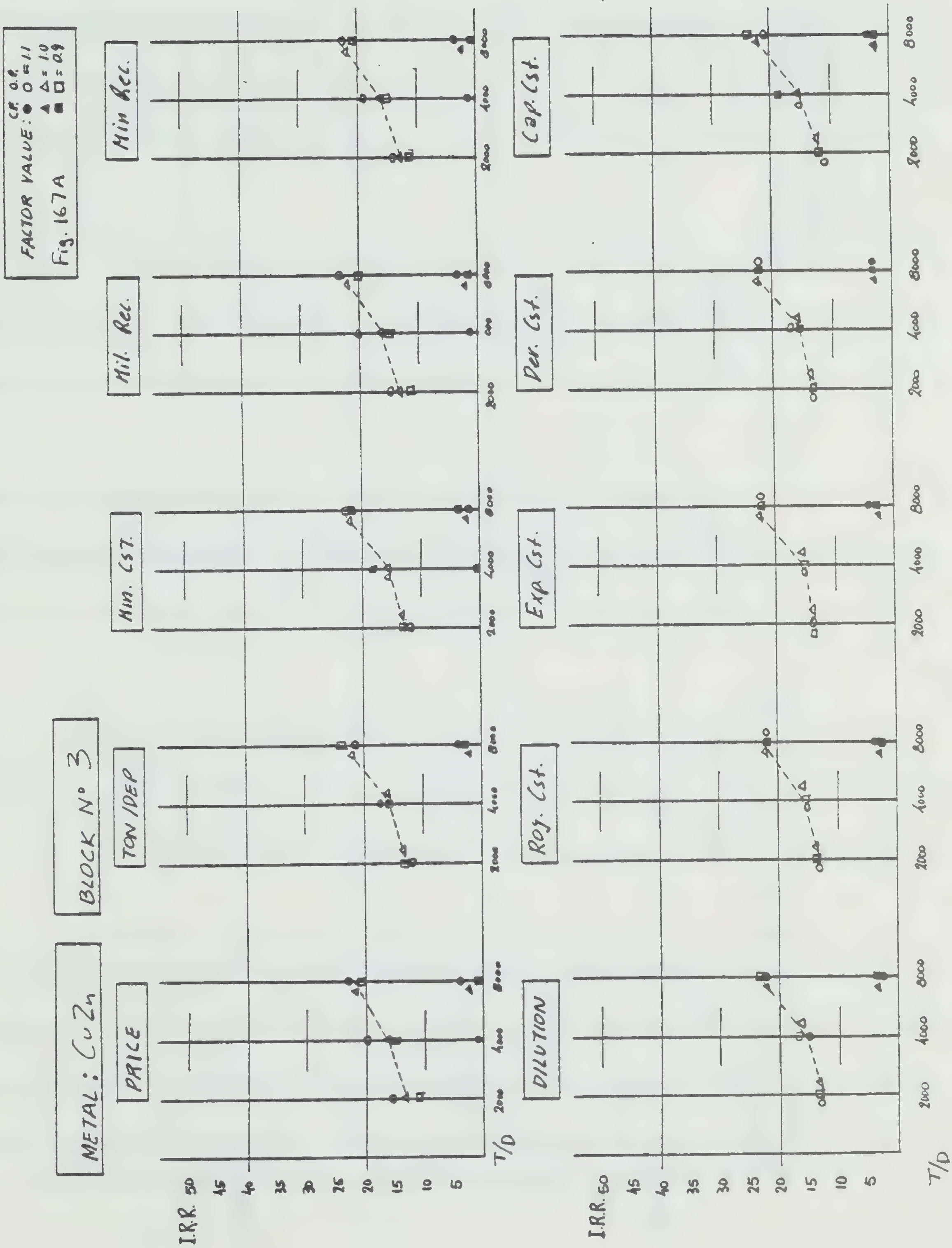


Fig. 165A
FACTOR VALUE: CF. O.P. ● O = 1.1 ▲ Δ = 1.0 ■ □ = 0.9
METAL: Cu Zn
BLOCK N° 1
PRICE
TON/DEP
Min. Cst.
Mil. Rec.
Min Rec.
DILUTION
Roy. Cst.
Exp Cst.
Dev. Cst.
Cap. Cst.
I.R.R.
T/D

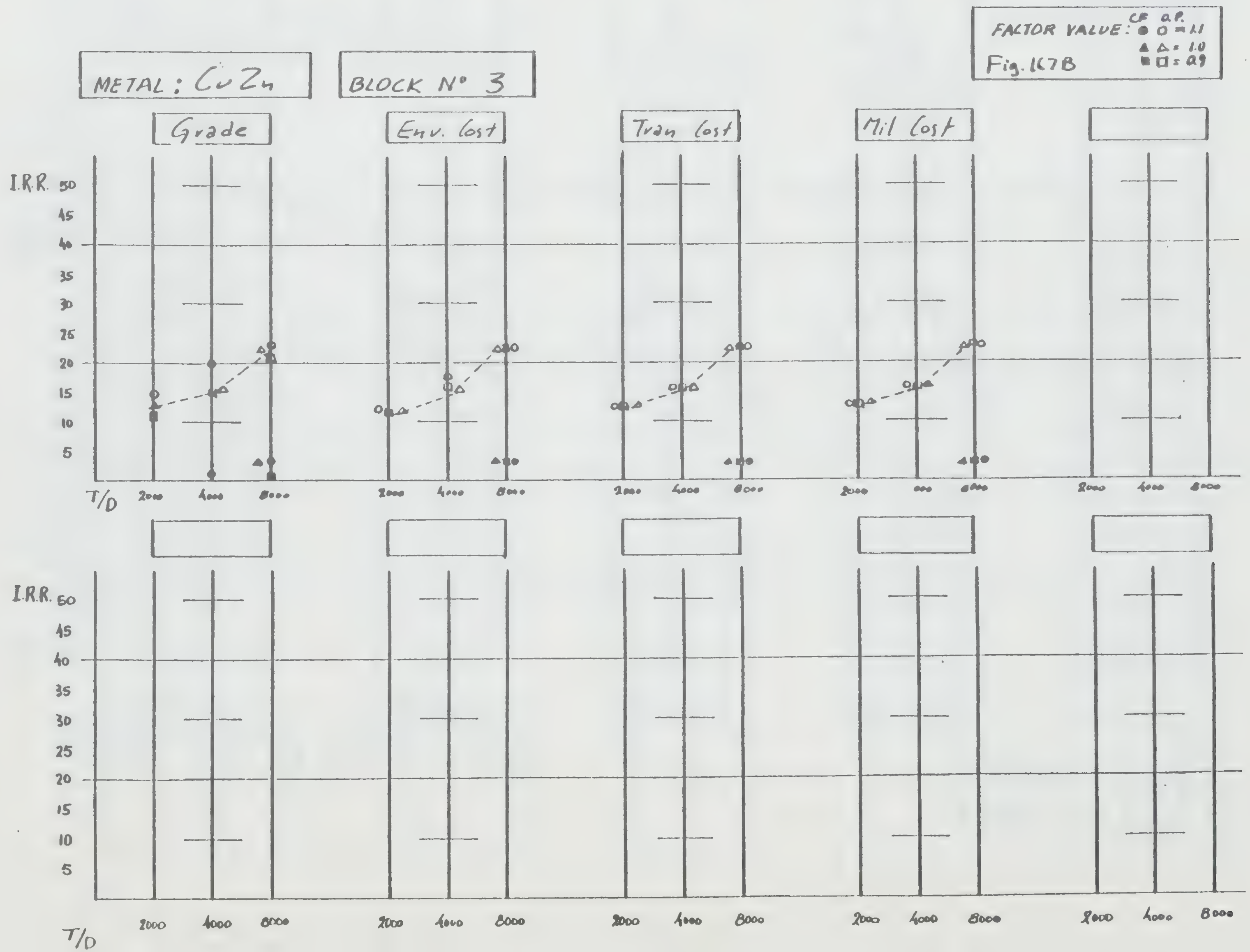

FACTOR VALUE: C.F. O.P.
○ = 1.1
△ = 1.0
□ = 0.9
Fig. 165B
METAL: Cu Zn
BLOCK N° 1
Grade
Env. Cost
Tran Cost
Mil Cost.
I.R.R.
50
45
40
35
30
25
20
15
10
5
T/D
2000
4000
8000

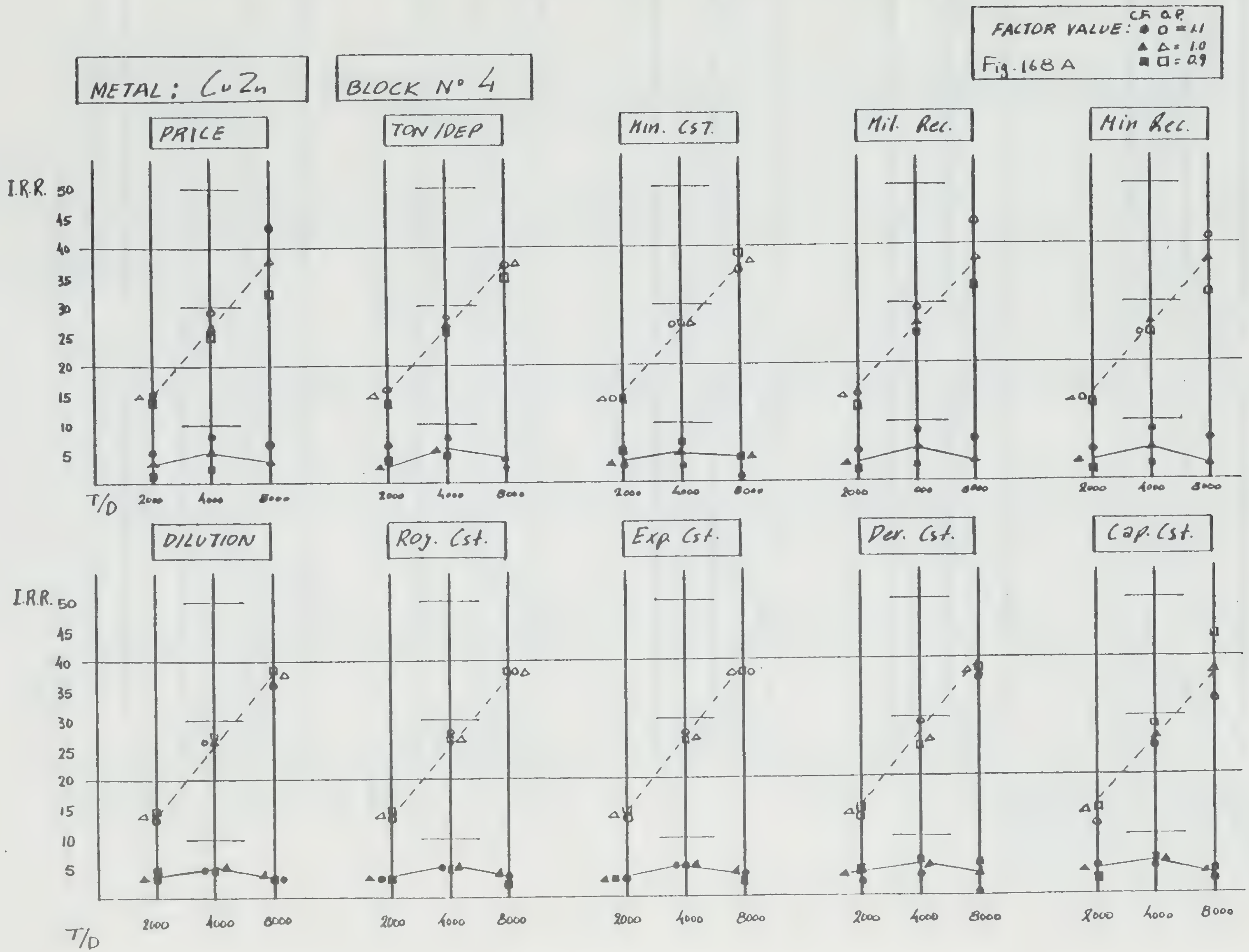

METAL : CuZn
BLOCK N° 2
FACTOR VALUE : C.F. O.P.
● ○ = 1.1
▲ △ = 1.0
■ □ = 0.9
Fig. 166 A
PRICE
TON/DEP
Min. CST.
Mil. Rec.
Min Rec.
DILUTION
Roy. Cst.
Exp. Cst.
Dev. Cst.
Cap. Cst.
I.R.R.
50 45 40 35 30 25 20 15 10 5
T/D
2000 4000 8000

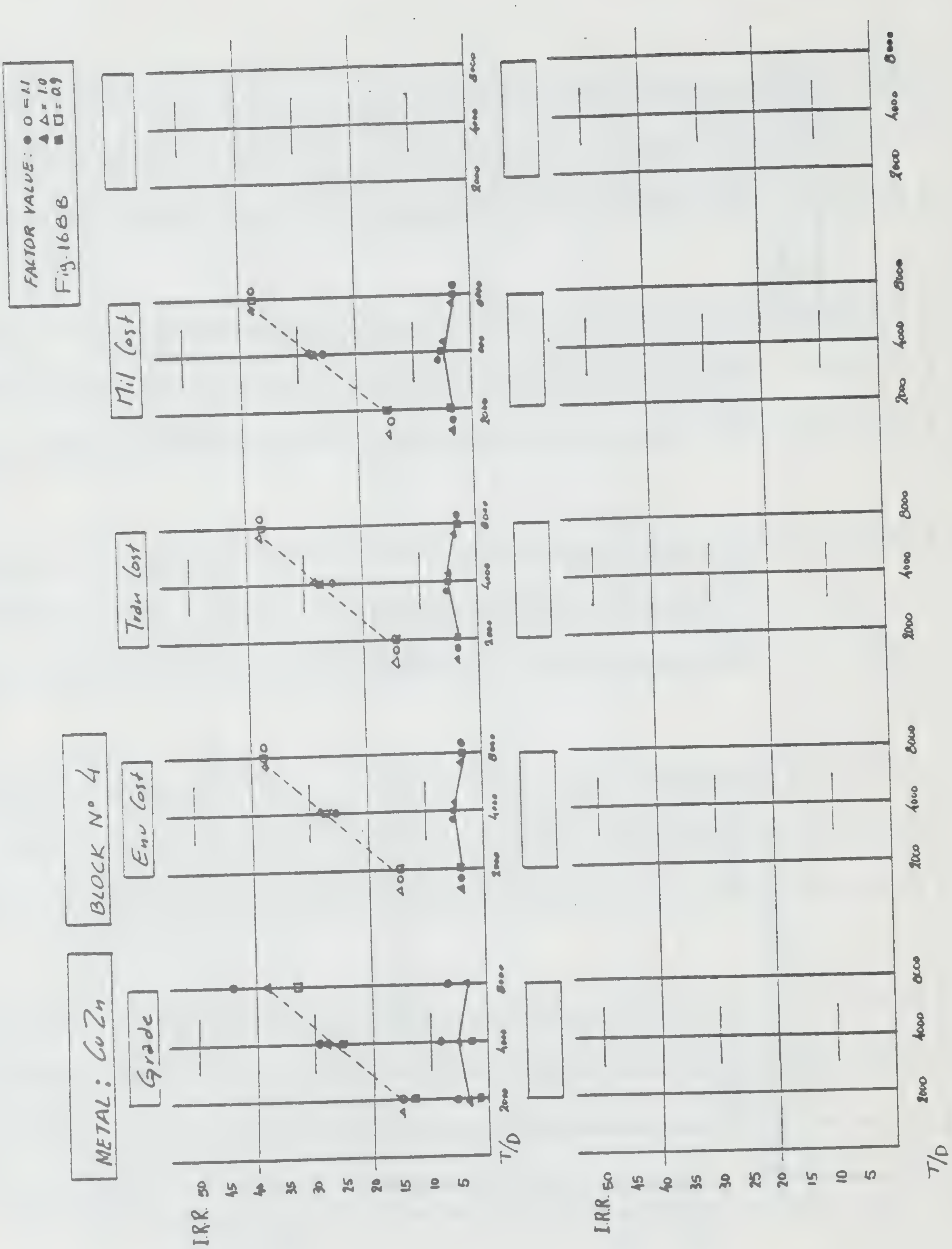

METAL : Cu Zn
BLOCK N° 2
FACTOR VALUE : CF. O.P. ● ○ = 1.1 ▲ △ = 1.0 ■ □ = 0.9
Fig 166 B
Grade
Env. Cost
Tran Cost
Mil Cost.
I.R.R.
50
45
40
35
30
25
20
15
10
5
T/D
2000
4000
8000

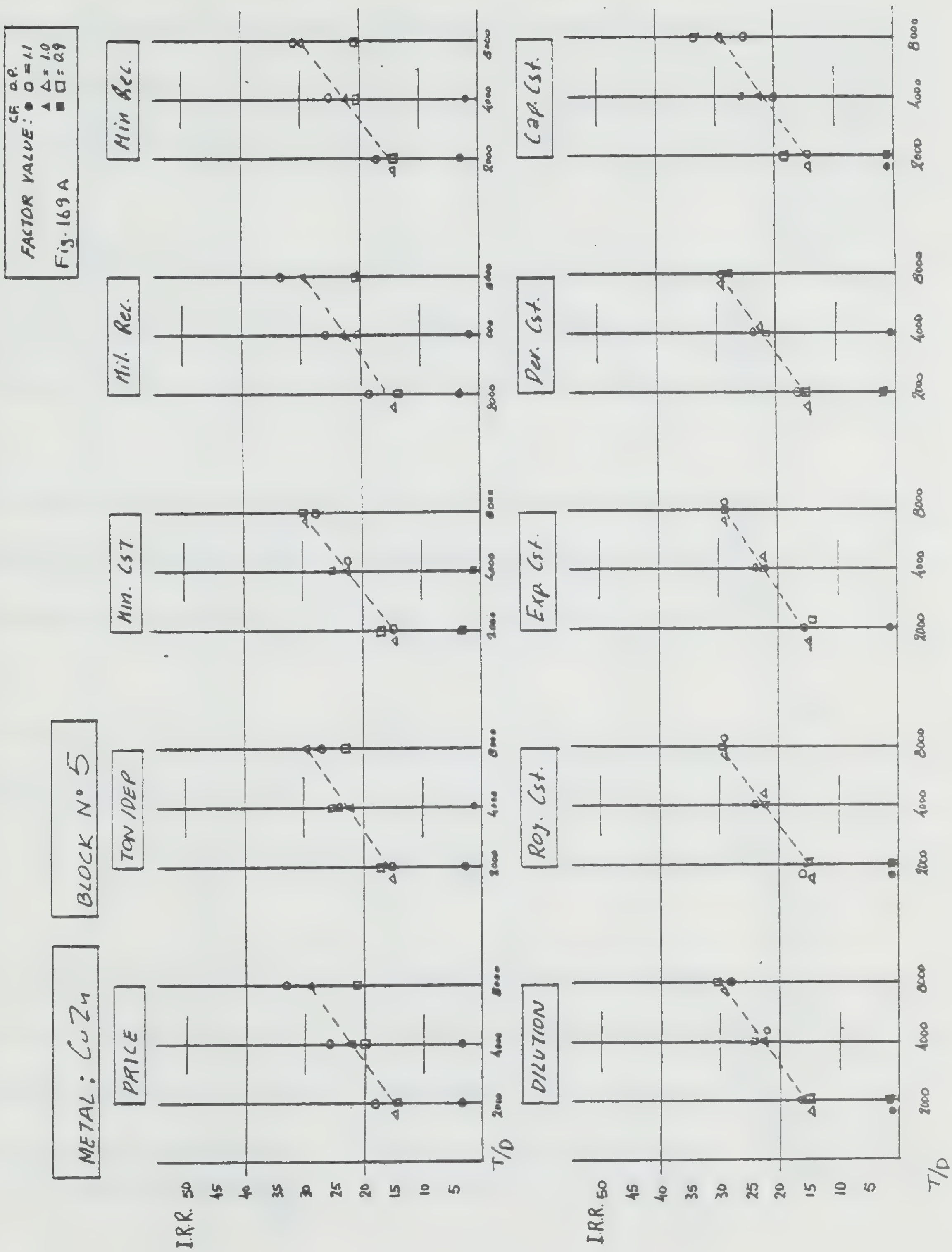


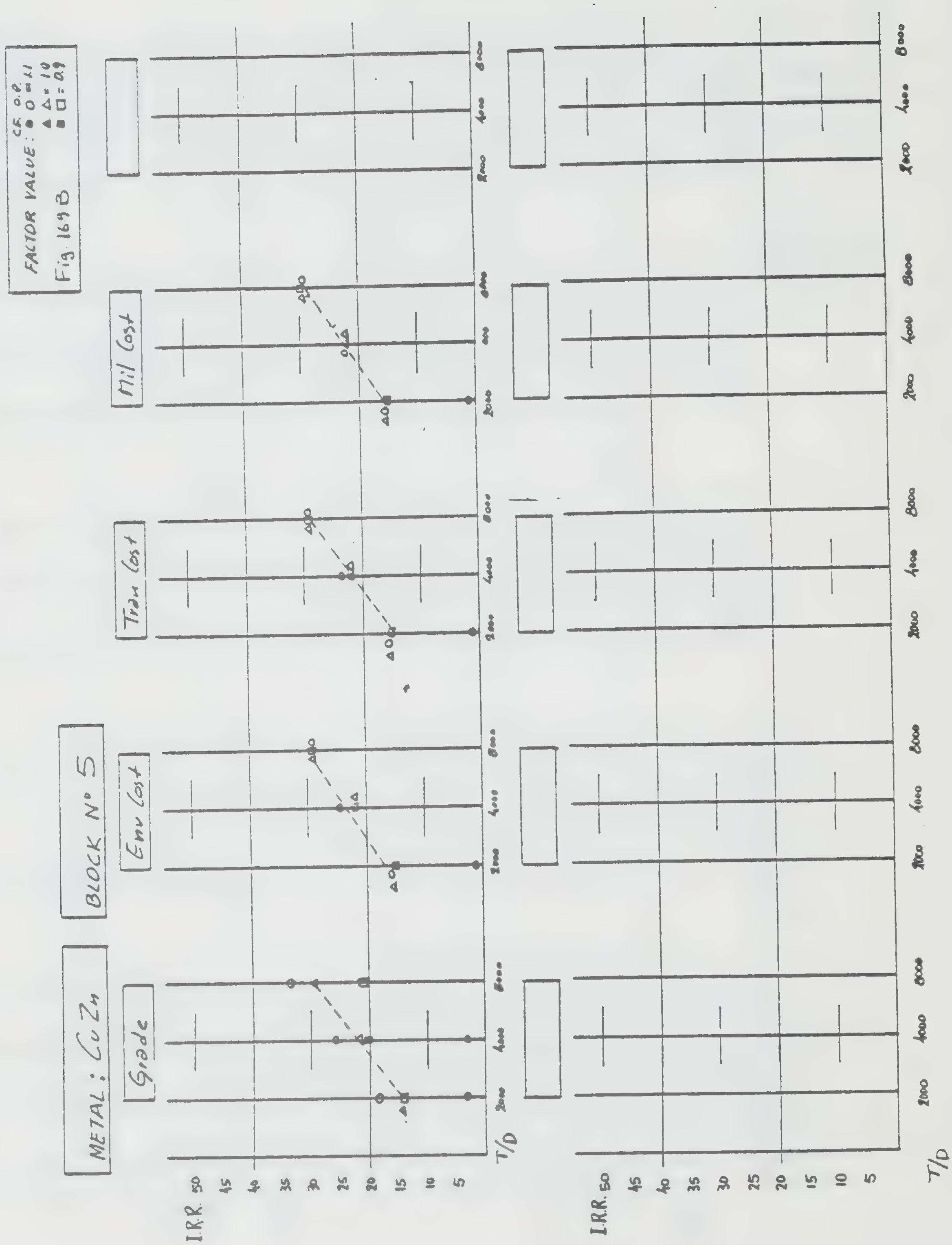
METAL : CuZn
BLOCK N° 3
FACTOR VALUE : C.F. O.P. ● ○ = 1.1 ▲ △ = 1.0 ■ □ = 0.9
Fig. 167A
PRICE
TON/DEP
MIN. CST.
MIL. REC.
MIN REC.
DILUTION
ROY. CST.
EXP CST.
DEP. CST.
CAP. CST.
I.R.R.
T/D
50
45
40
35
30
25
20
15
10
5
2000
4000
8000

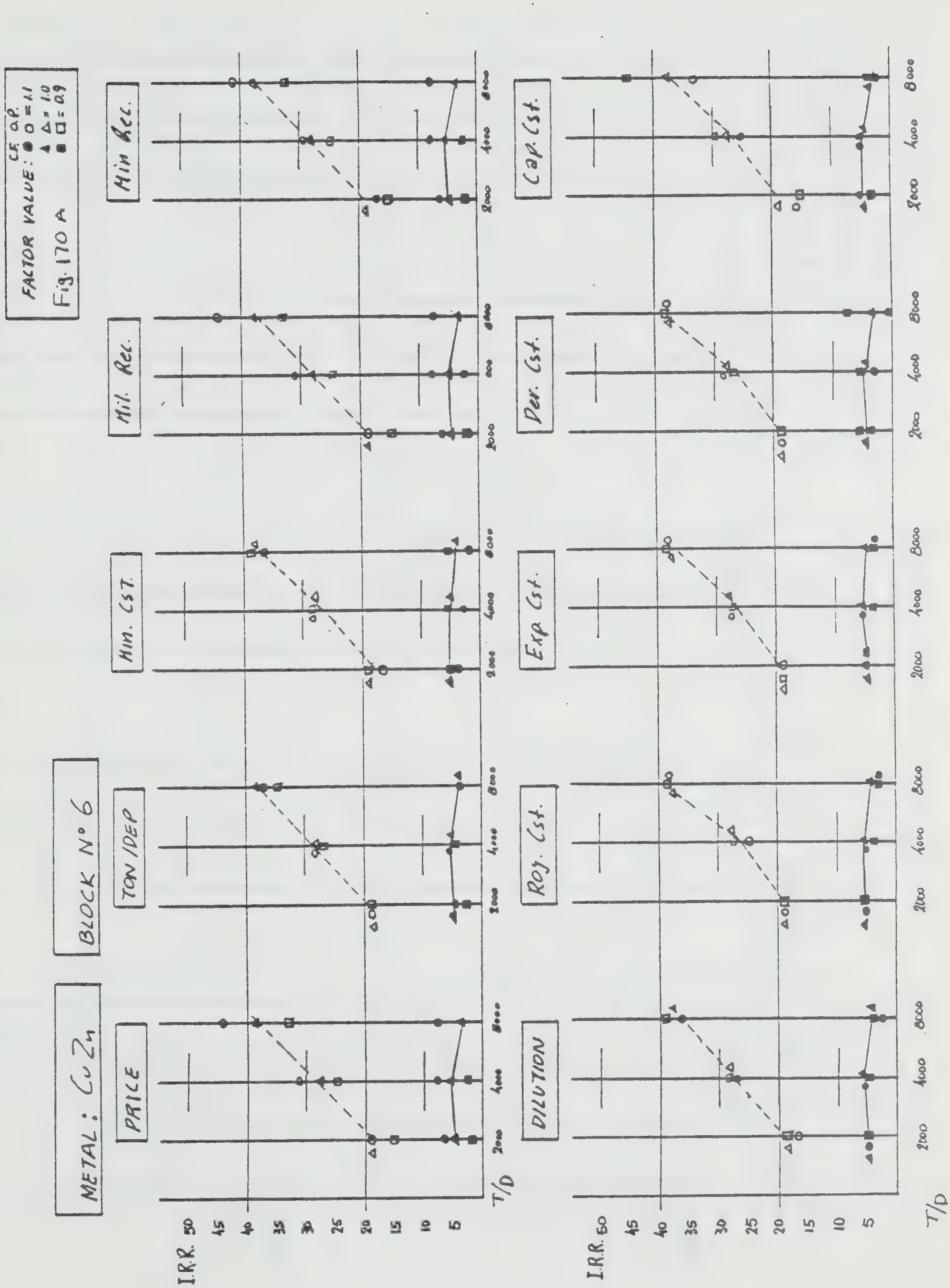

METAL : CuZn
BLOCK N° 3
FACTOR VALUE: CF O.P. ● ○ = 1.1 ▲ △ = 1.0 ■ □ = 0.9
Fig. 167B
Grade
Env. Cost
Tran Cost
Mil Cost
I.R.R.
50 45 40 35 30 25 20 15 10 5
T/D
2000 4000 8000

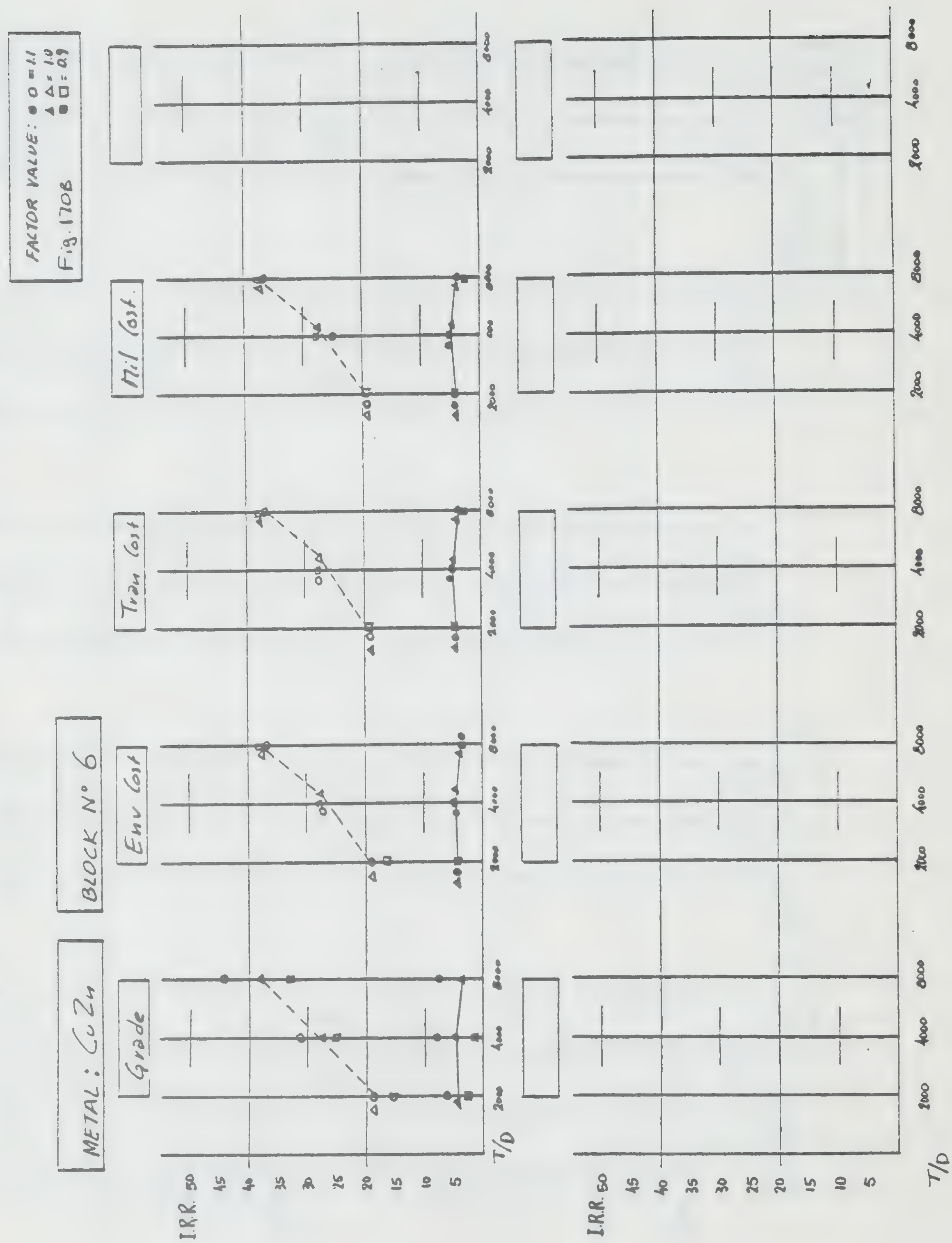

METAL: CuZn
BLOCK N° 4
FACTOR VALUE: C.F. O.P. ● ○ = 1.1 ▲ △ = 1.0 ■ □ = 0.9
Fig. 168 A
PRICE
TON/DEP
Min. CST.
Mil. Rec.
Min Rec.
DILUTION
Roy. Cst.
Exp Cst.
Der. Cst.
Cap. Cst.
I.R.R.
50
45
40
35
30
25
20
15
10
5
T/D
2000
4000
8000

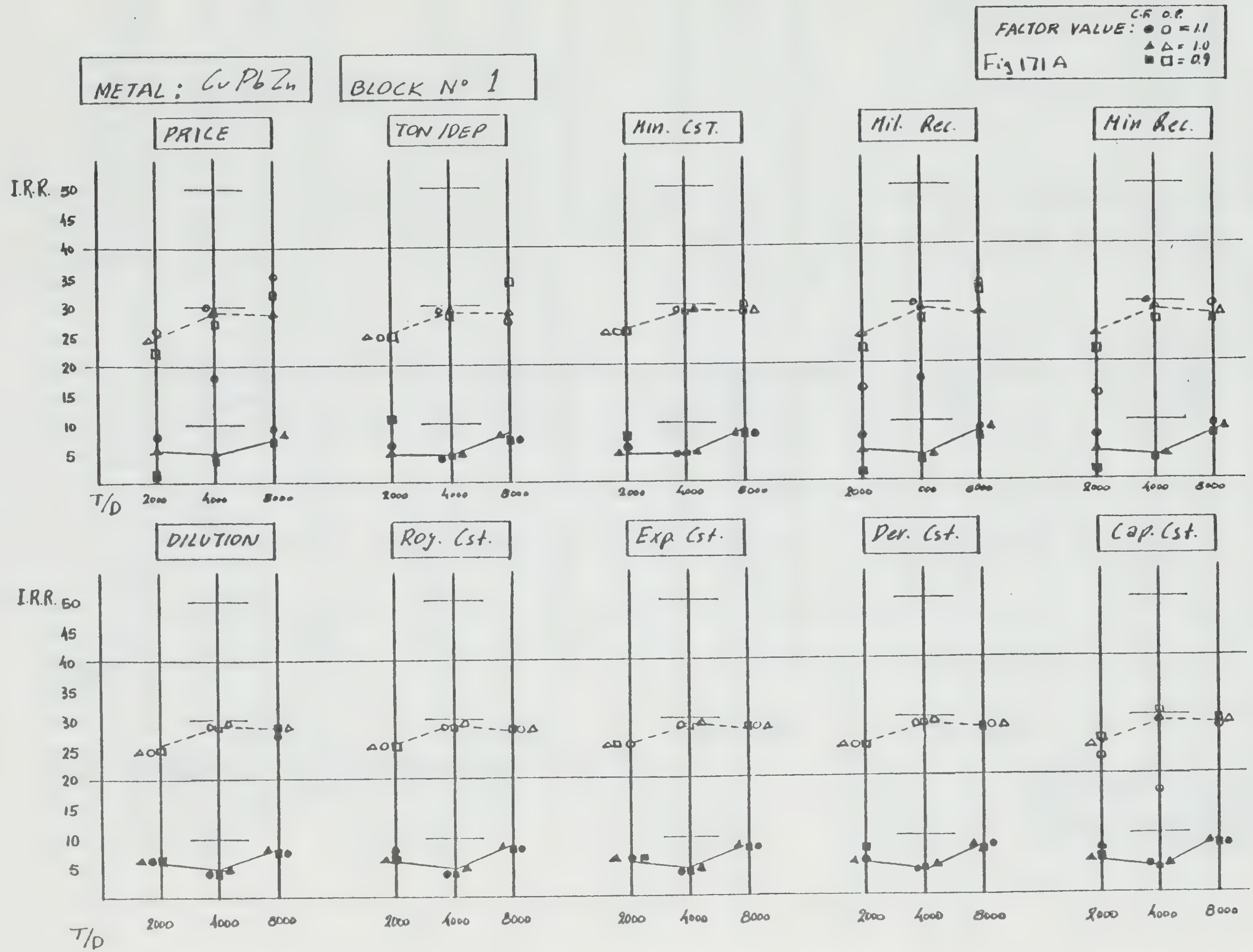

FACTOR VALUE: ● ○ = 1.1
▲ △ = 1.0
■ □ = 0.9
Fig. 16BB
METAL: CuZn
BLOCK No 4
Grade
Env Cost
Tran Cost
Mil Cost
I.R.R.
T/D
50 45 40 35 30 25 20 15 10 5
2000 4000 8000

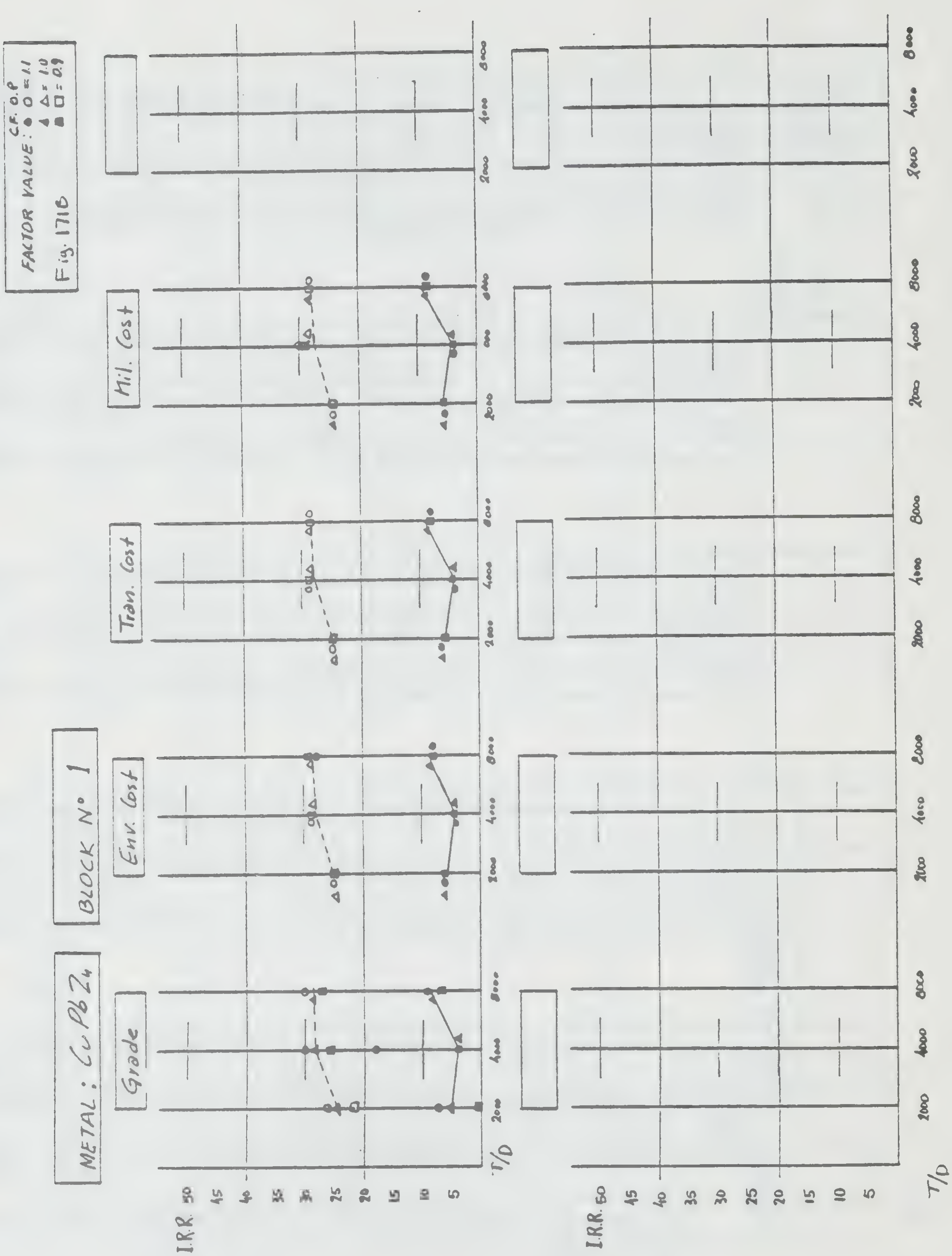

METAL: CuZn
BLOCK N° 5
FACTOR VALUE: CF. O.P. ● ○ = 1.1
▲ △ = 1.0
■ □ = 0.9
Fig. 169 A
PRICE
TON/DEP
MIN. CST.
Mil. Rec.
Min Rec.
DILUTION
Roy. Cst.
Exp Cst.
Dev. Cst.
Cap. Cst.
I.R.R.
T/D
50 45 40 35 30 25 20 15 10 5
2000 4000 8000

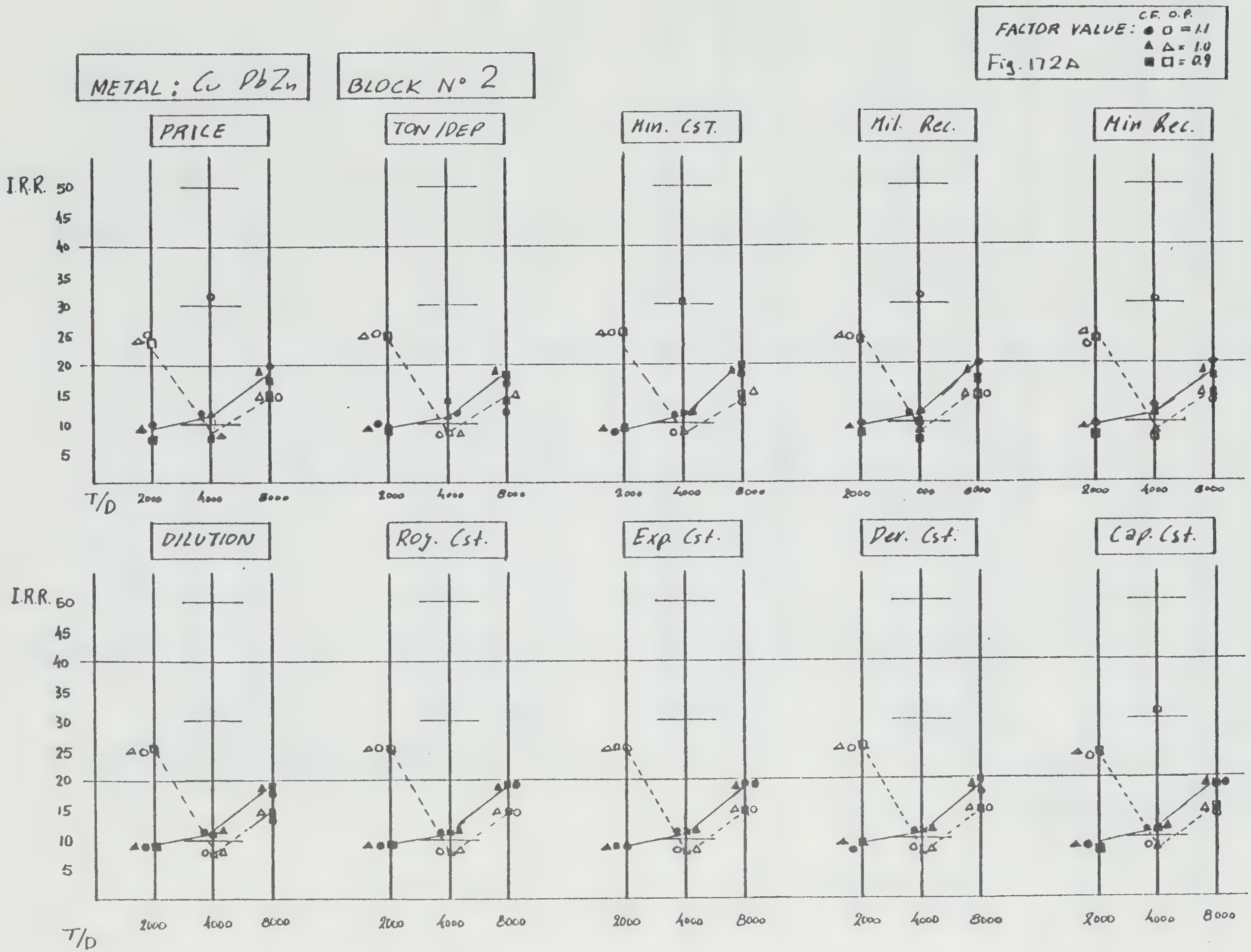

METAL : Cu Zn
BLOCK N° 5
Grade
Env Cost
Tran Cost
Mil Cost
FACTOR VALUE : C.F. 0.8 ● ○ = 1.1 ▲ △ = 1.0 ■ □ = 0.9
Fig. 169 B
I.R.R.
50 45 40 35 30 25 20 15 10 5
T/D
2000 4000 8000

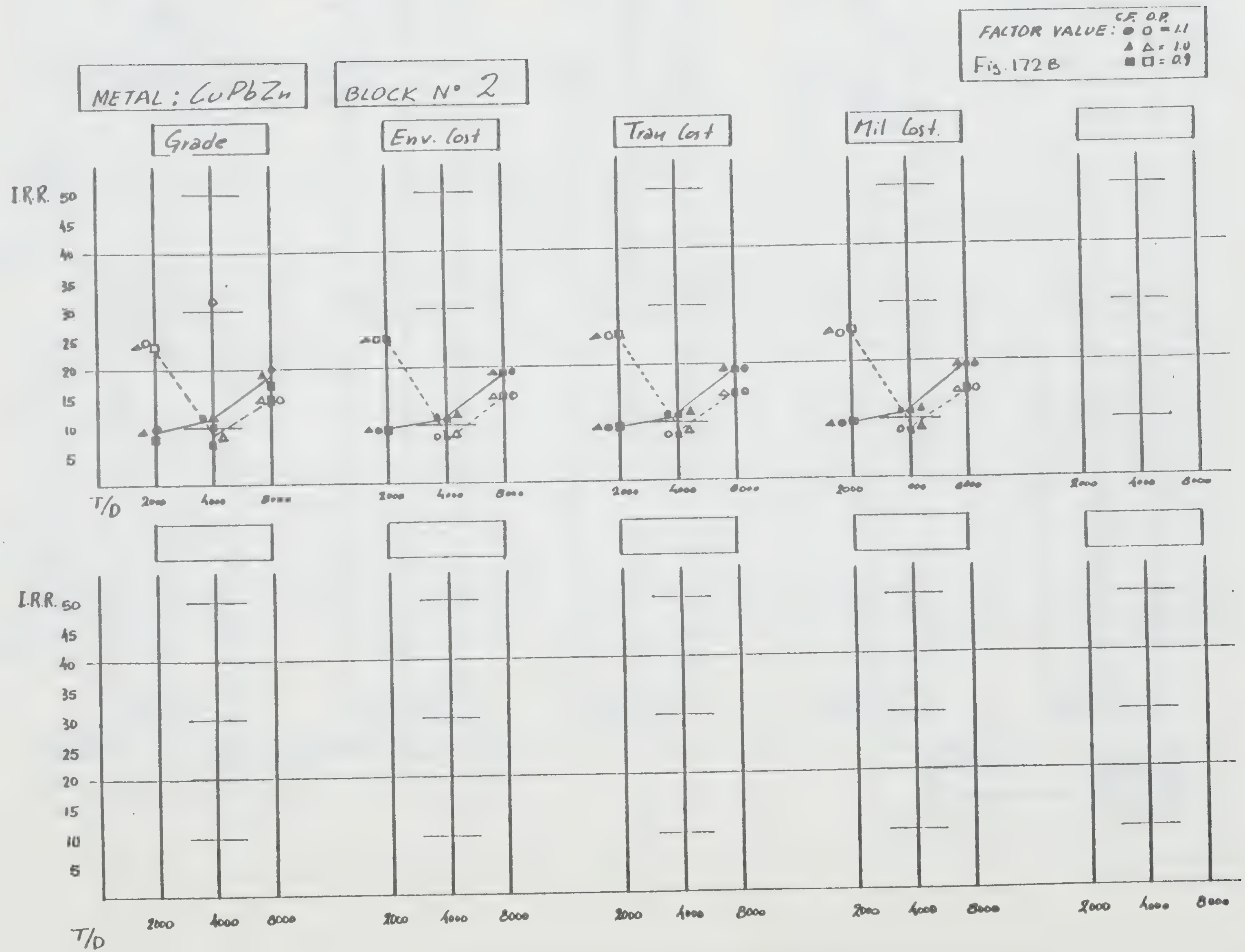

METAL : Cu Zn
BLOCK N° 6
FACTOR VALUE : C.F. O.P. ● ○ = 1.1 ▲ △ = 1.0 ■ □ = 0.9
Fig. 170 A
PRICE
TON/DEP
Min. CST.
Mil. Rec.
Min Rec.
DILUTION
Roy. Cst.
Exp Cst.
Dev. Cst.
Cap. Cst.
I.R.R.
T/D

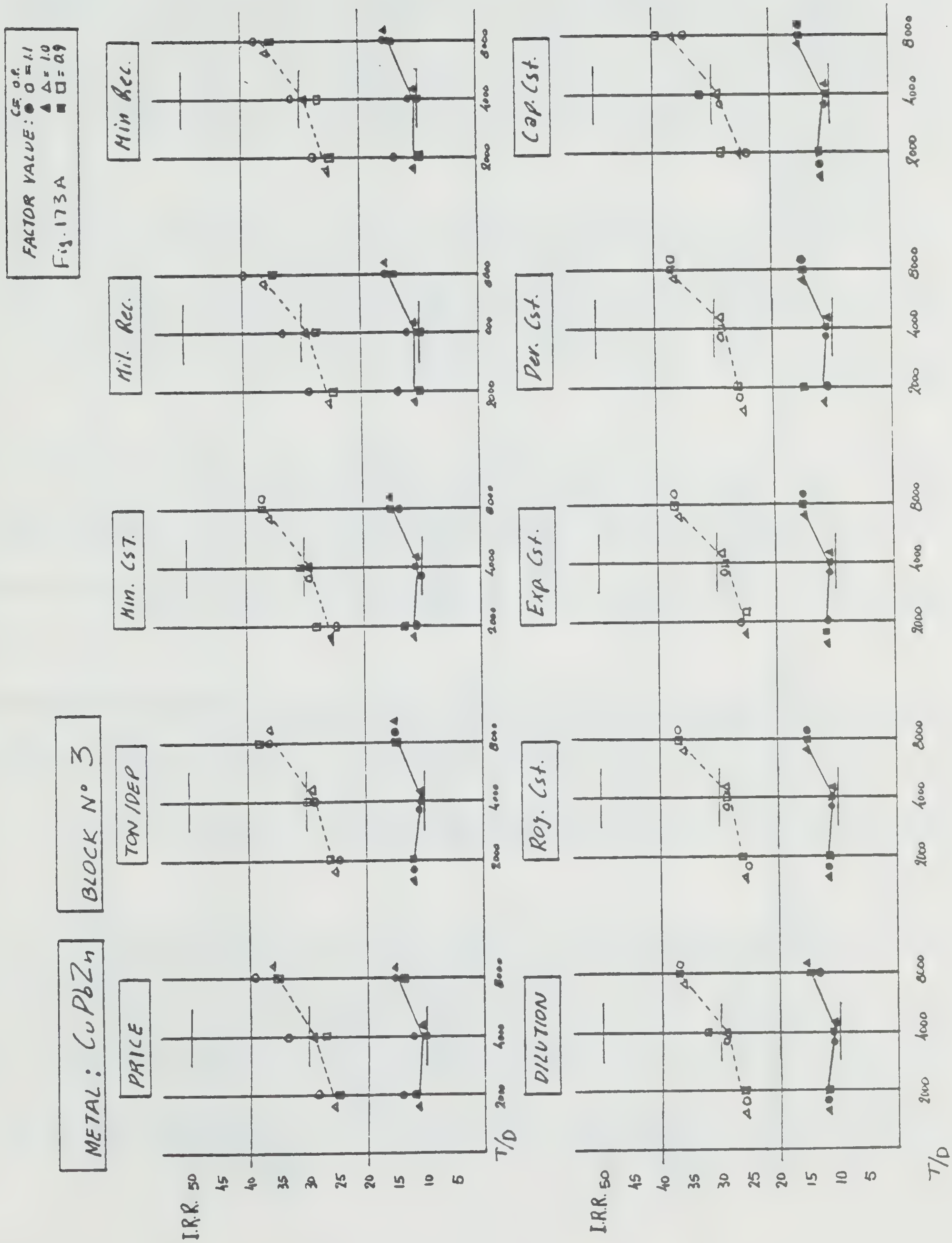

FACTOR VALUE: ● ○ = 1.1
▲ △ = 1.0
■ □ = 0.9
Fig. 170B
METAL: CuZn
BLOCK N° 6
Grade
Env Cost
Tran Cost
Mil Cost.
I.R.R.
50
45
40
35
30
25
20
15
10
5
T/D
2000
4000
8000

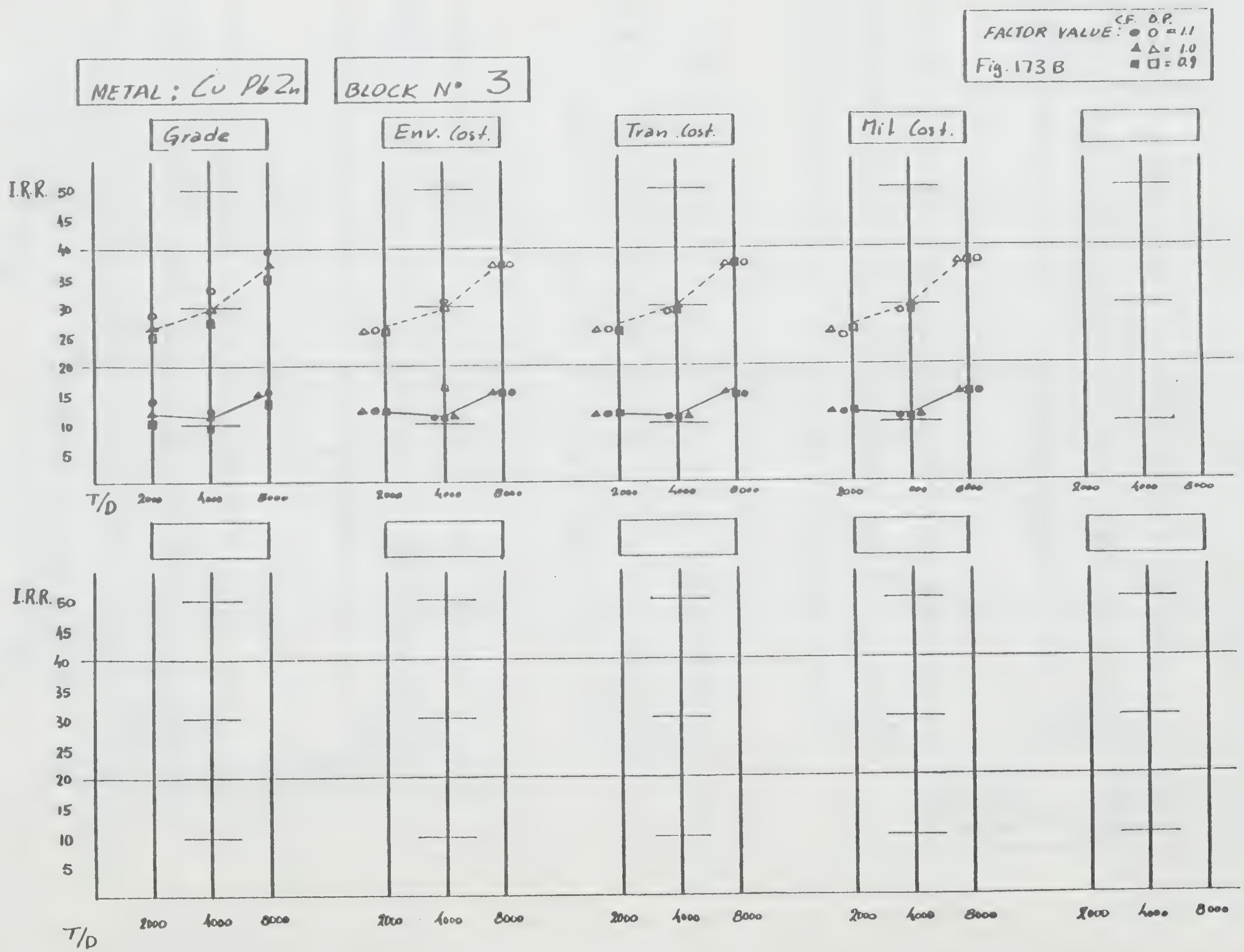

FACTOR VALUE: C.F. O.P. ● ○ = 1.1 ▲ △ = 1.0 ■ □ = 0.9
Fig 171 A
METAL: Cu Pb Zn
BLOCK N° 1
PRICE
TON/DEP
Min. CST.
Mil. Rec.
Min Rec.
DILUTION
Roy. Cst.
Exp Cst.
Dev. Cst.
Cap. Cst.
I.R.R.
T/D
2000
4000
8000

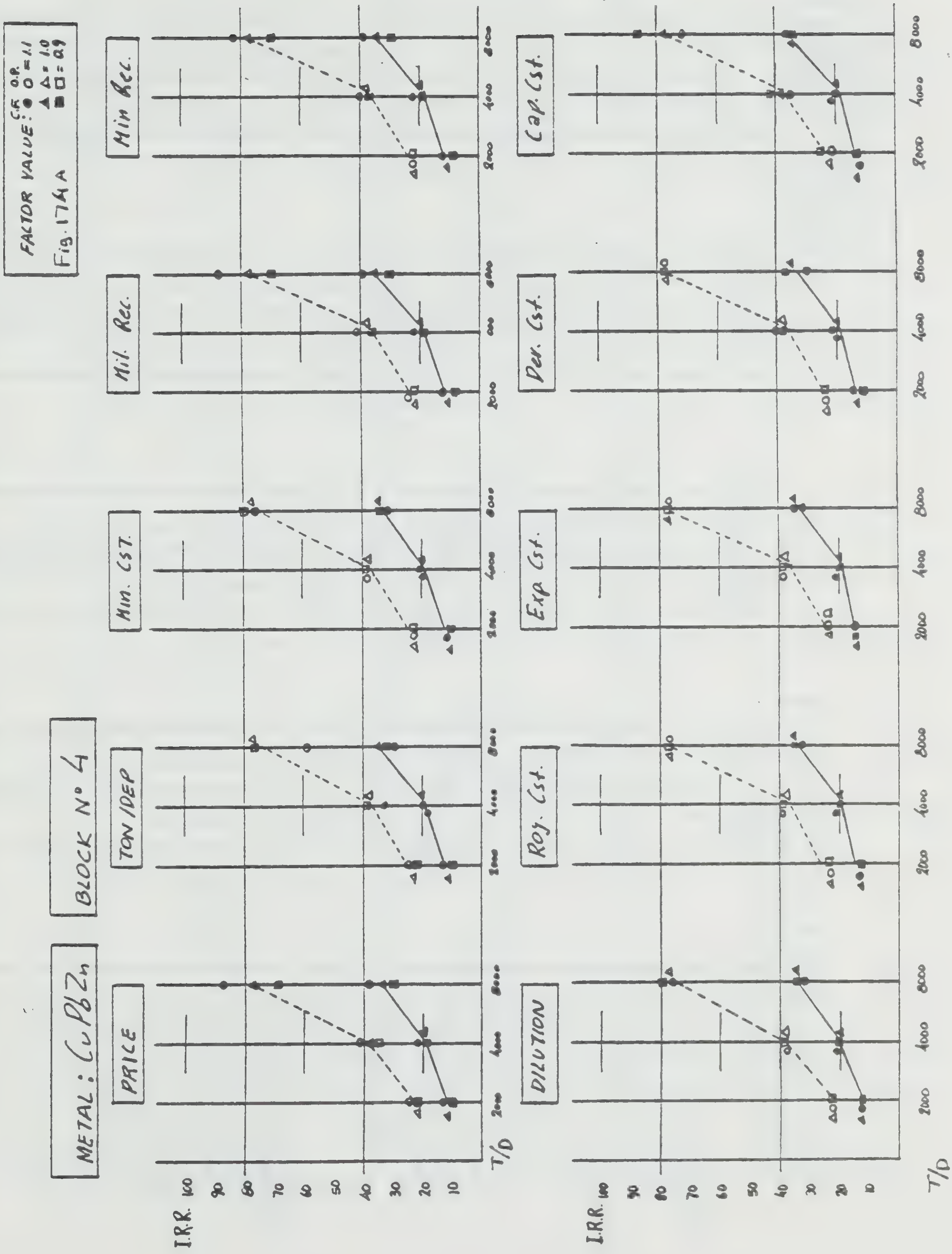

METAL : Cu Pb Z4
BLOCK N° 1
FACTOR VALUE : C.F. O.P ● ○ = 1.1 ▲ △ = 1.0 ■ □ = 0.9
Fig. 171B
Grade
Env. Cost
Tran. Cost
Mil. Cost
I.R.R.
T/D

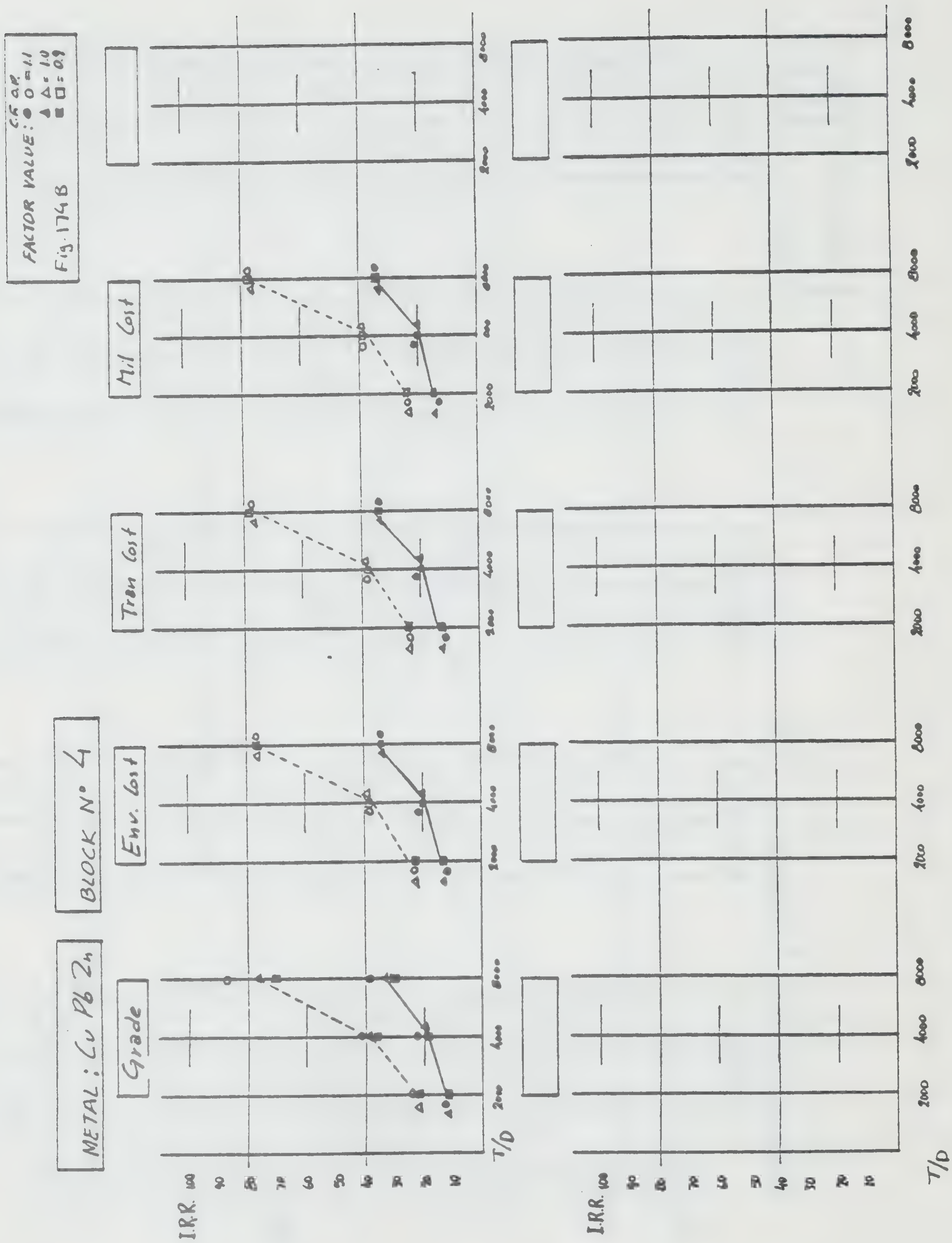

METAL: Cu Pb Zn
BLOCK N° 2
FACTOR VALUE: C.F. O.P.
● ○ = 1.1
▲ △ = 1.0
■ □ = 0.9
Fig. 172A
PRICE
TON/DEP
Min. CST.
Mil. Rec.
Min Rec.
DILUTION
Roy. Cst.
Exp Cst.
Der. Cst.
Cap. Cst.
I.R.R.
50
45
40
35
30
25
20
15
10
5
T/D
2000
4000
8000

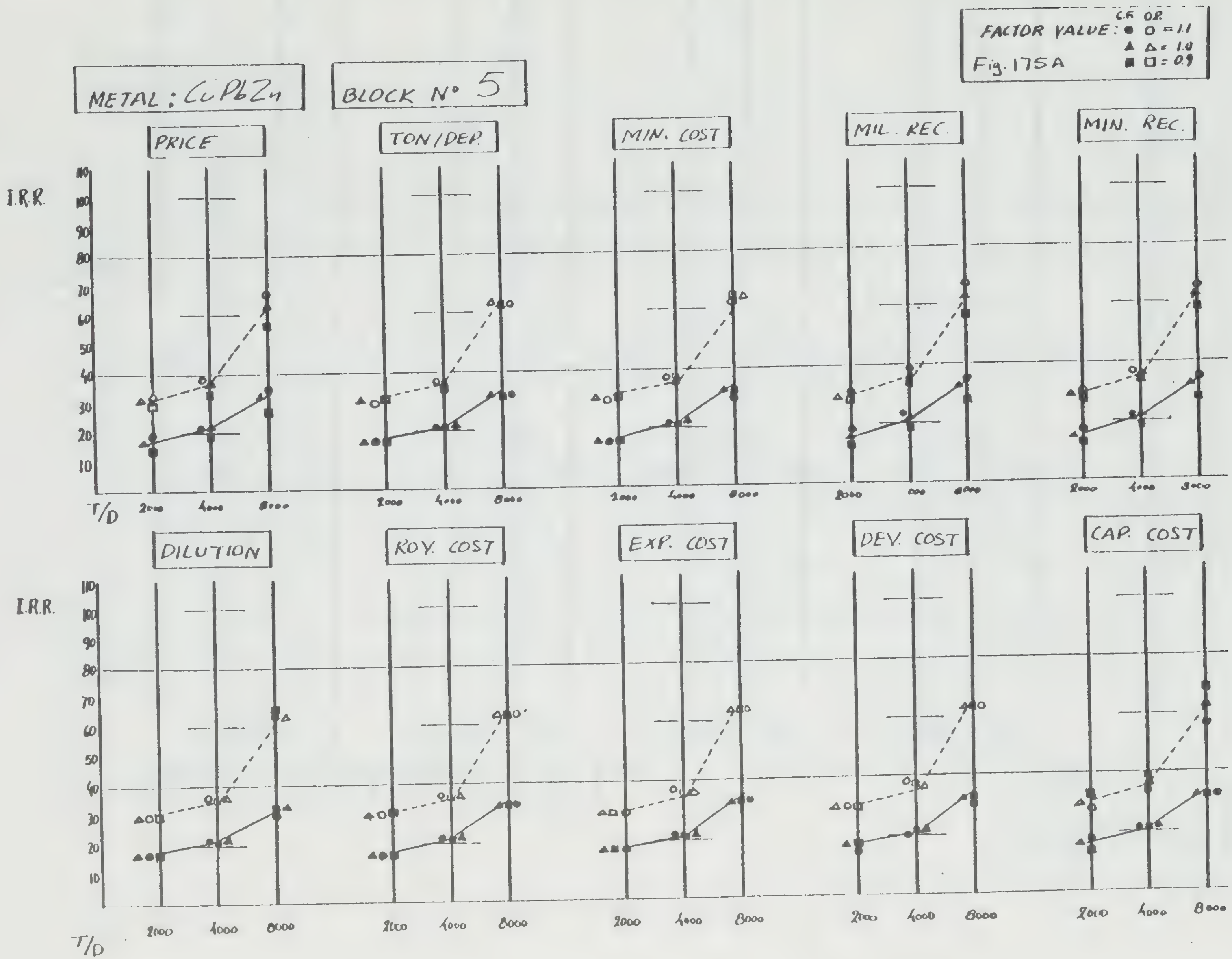

METAL : CuPbZn
BLOCK N° 2
FACTOR VALUE : C.F. O.P. ● ○ = 1.1 ▲ △ = 1.0 ■ □ = 0.9
Fig. 172 B
Grade
Env. Cost
Tran Cost
Mil Cost.
I.R.R.
50 45 40 35 30 25 20 15 10 5
T/D
2000 4000 8000

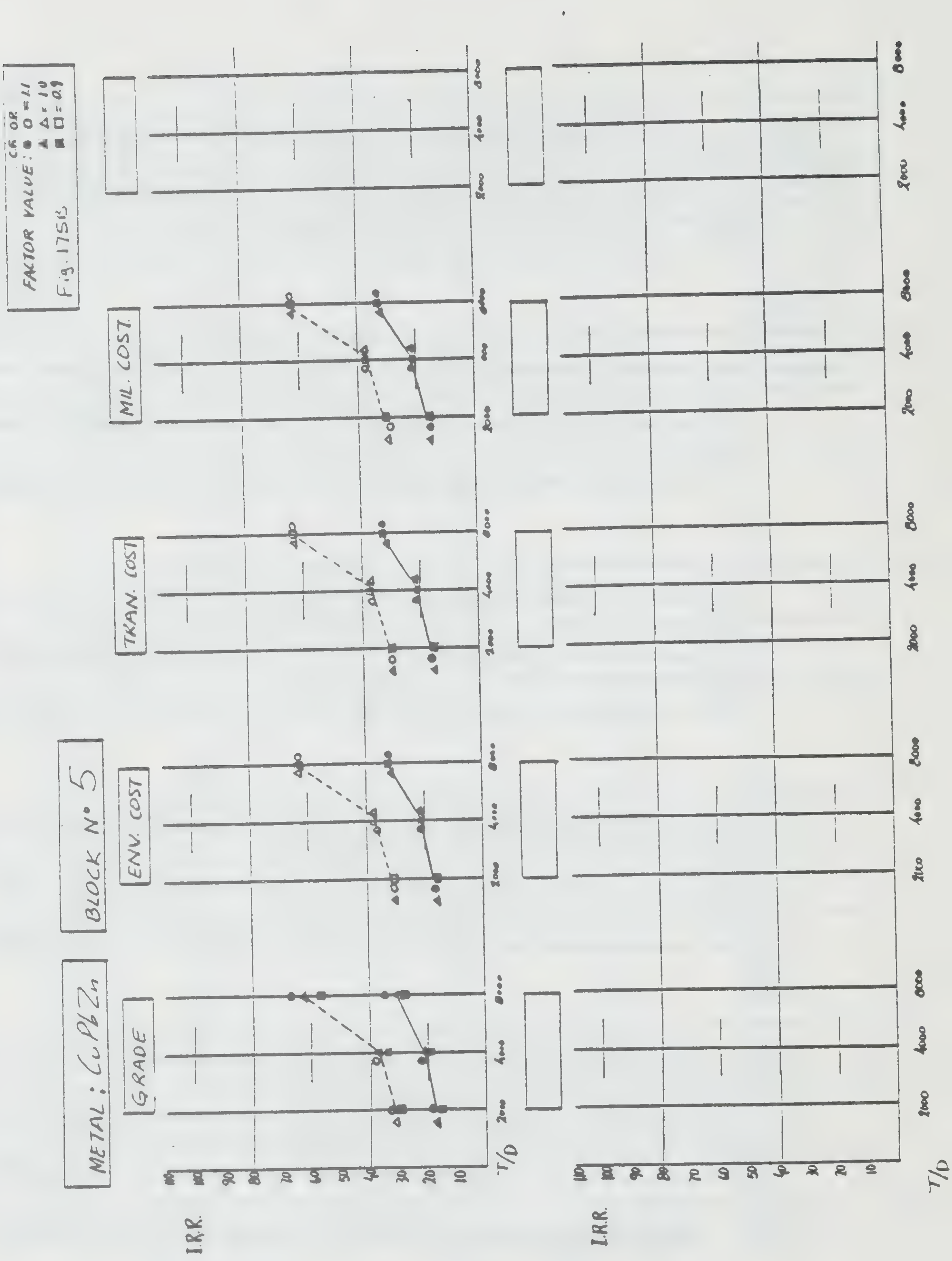

METAL: CuPbZn
BLOCK N° 3
FACTOR VALUE:
Fig. 173A
PRICE
TON/DEP
Min. Cst.
Mil. Rec.
Min Rec.
DILUTION
Roy. Cst.
Exp Cst.
Dev. Cst.
Cap. Cst.
I.R.R.
T/D

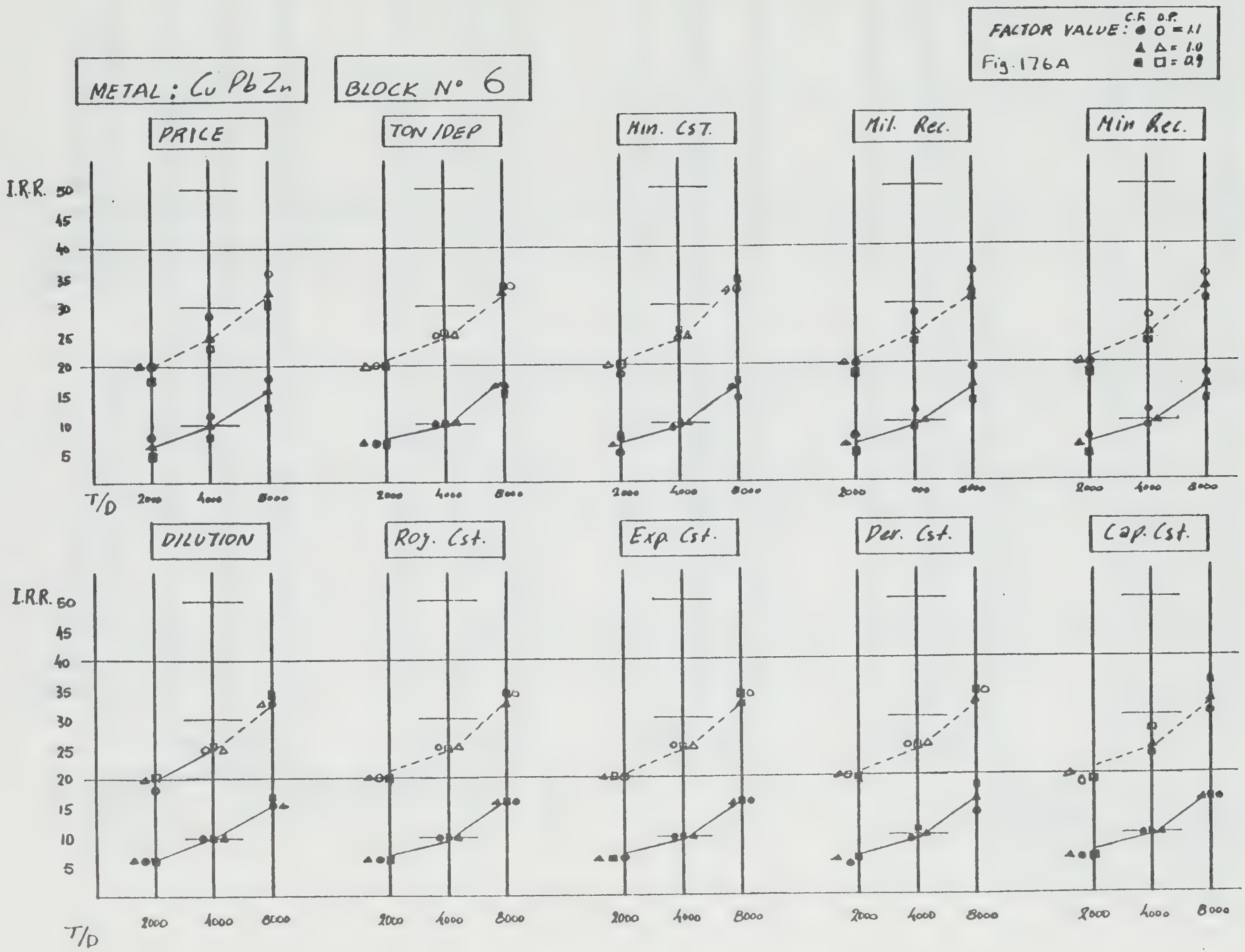

METAL : Cu Pb Zn
BLOCK N° 3
FACTOR VALUE: C.F. O.P.
● O = 1.1
▲ △ = 1.0
■ □ = 0.9
Fig. 173 B
Grade
Env. Cost.
Tran. Cost.
Mil. Cost.
I.R.R.
50
45
40
35
30
25
20
15
10
5
T/D
2000
4000
8000

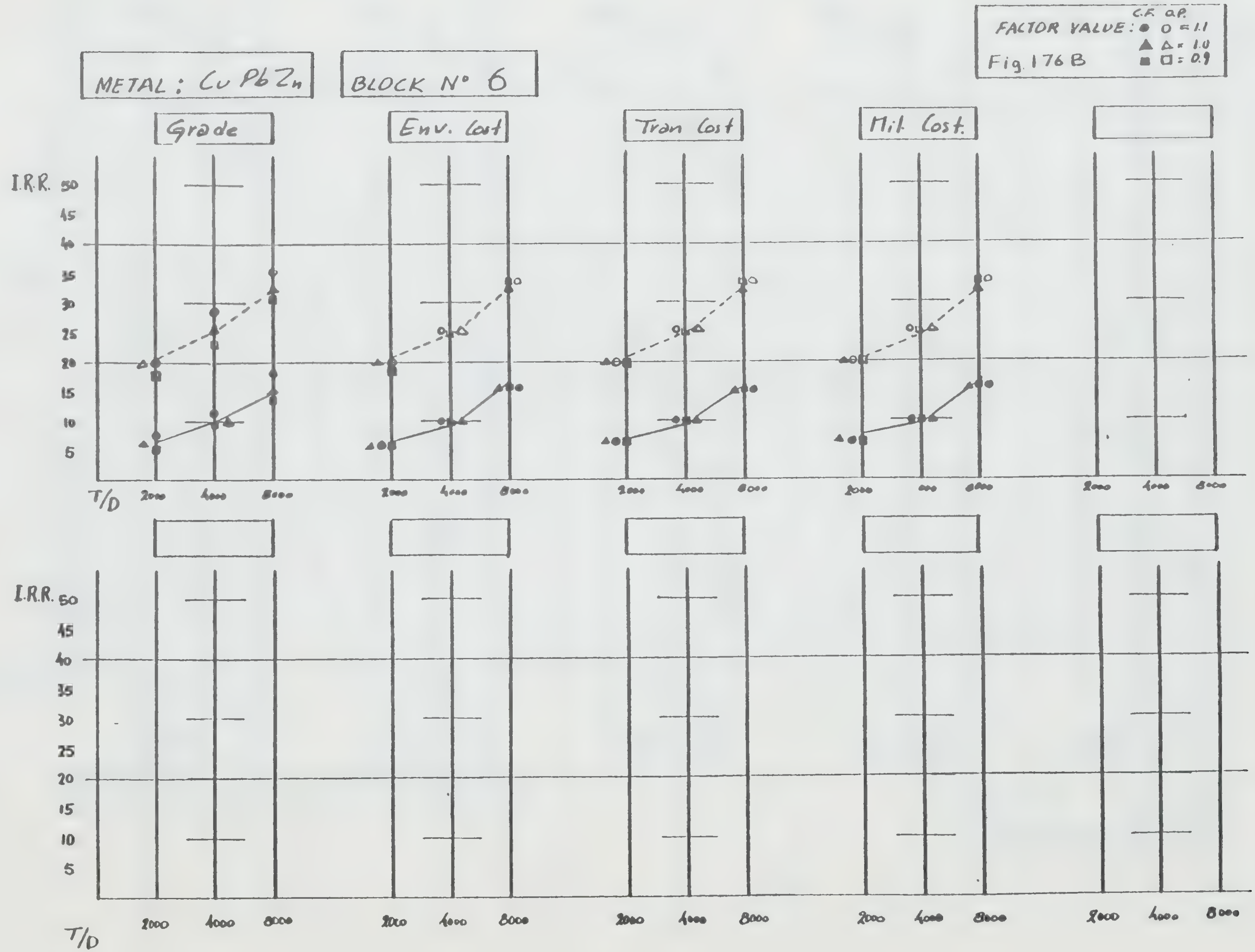

METAL: CuPbZn
BLOCK No 4
FACTOR VALUE: C.F. O.P.
● ○ = 1.1
▲ △ = 1.0
■ □ = 0.9
Fig. 17AA
PRICE
TON/DEP
Min. CST.
Mil. Rec.
Min Rec.
DILUTION
Roy. Cst.
Exp Cst.
Dev. Cst.
Cap. Cst.
I.R.R.
T/D
100 90 80 70 60 50 40 30 20 10
2000 4000 8000

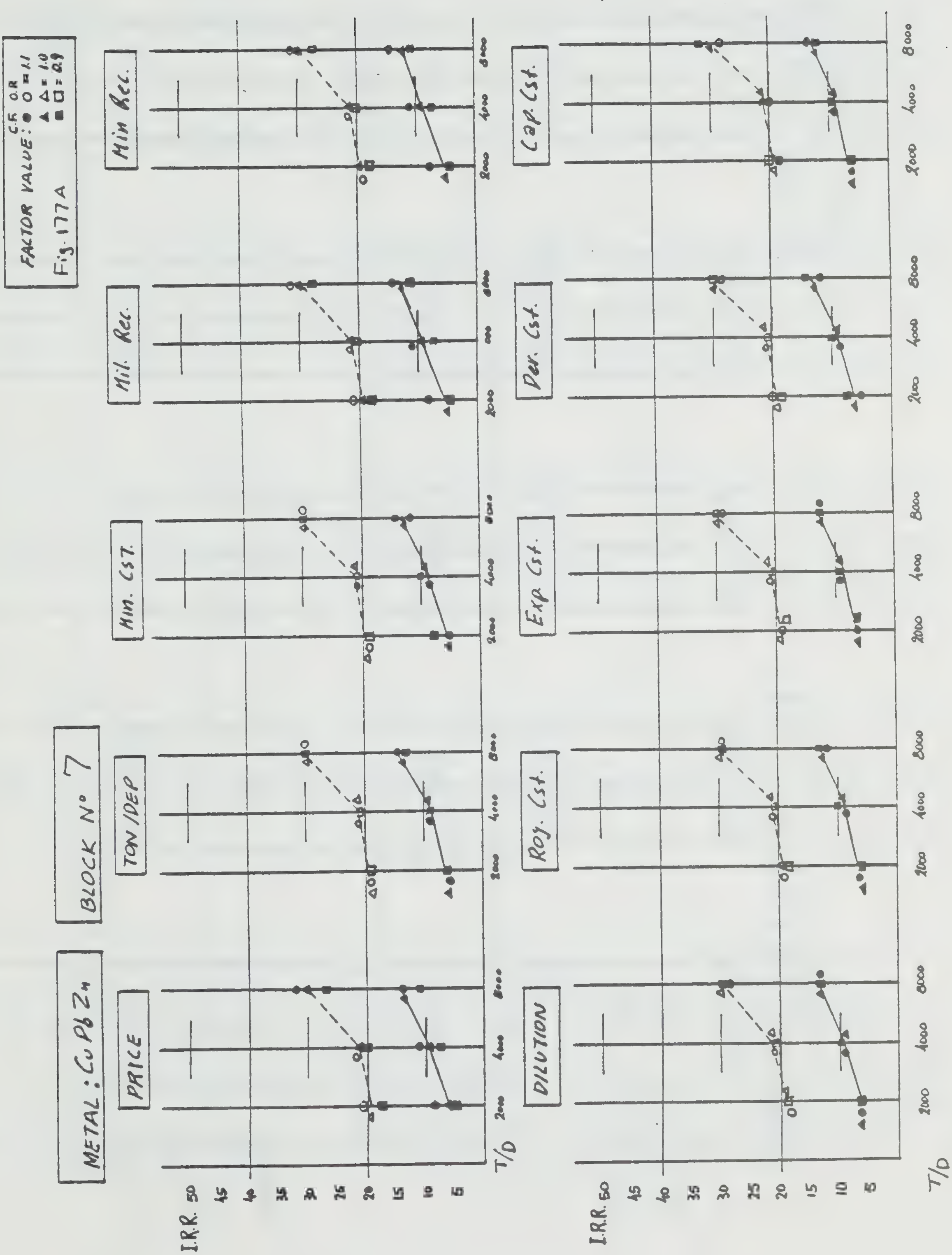

METAL: Cu Pb Zn
BLOCK N° 4
FACTOR VALUE: C.F. O.P. ● ○ = 1.1 ▲ △ = 1.0 ■ □ = 0.9
Fig. 174 B
Grade
Env. Cost
Tran Cost
Mil Cost
I.R.R.
T/D

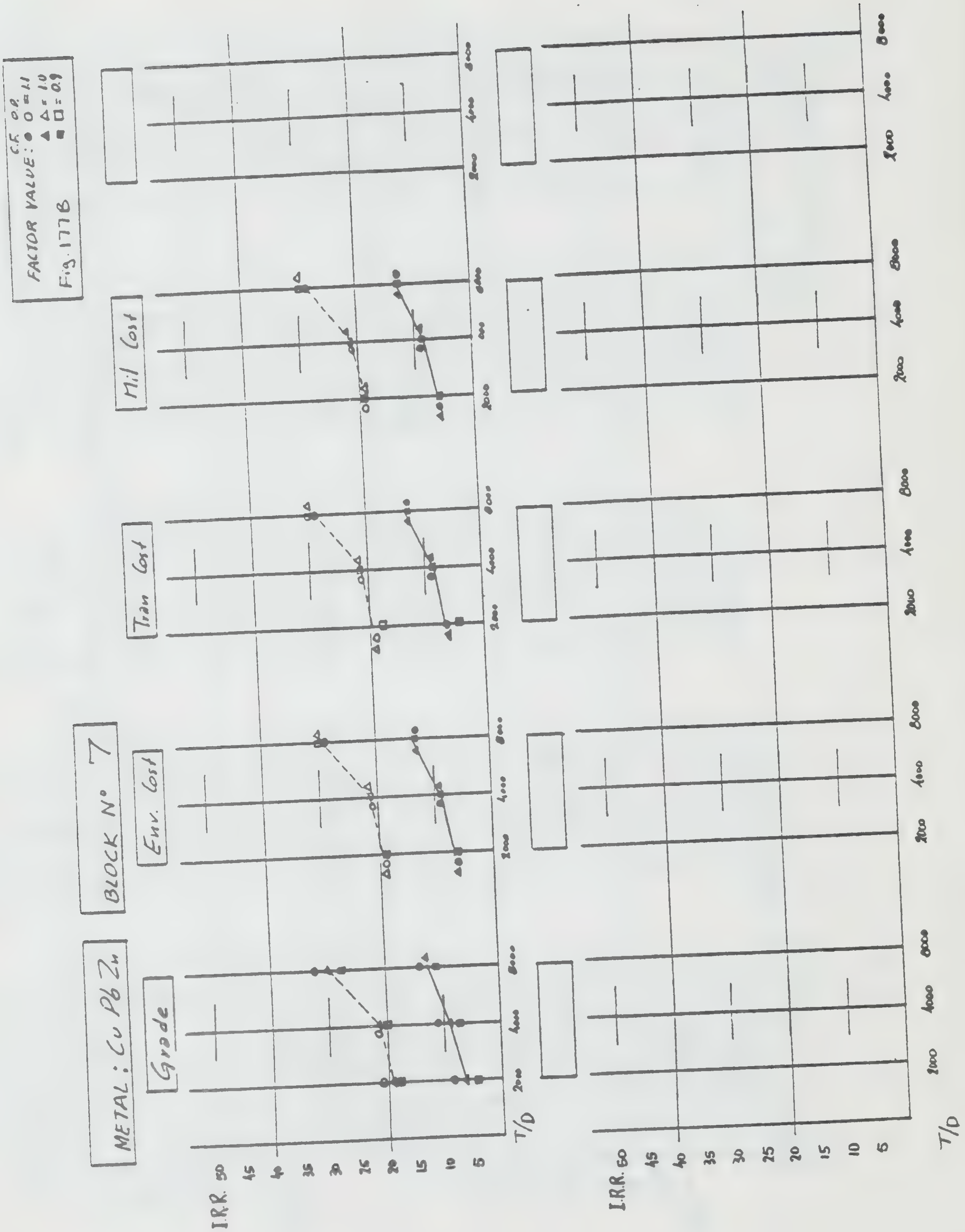

METAL: CuPbZn
BLOCK N° 5
FACTOR VALUE: C.F. O.R. ● ○ = 1.1 ▲ △ = 1.0 ■ □ = 0.9
Fig. 175A
PRICE
TON/DEP.
MIN. COST
MIL. REC.
MIN. REC.
DILUTION
ROY. COST
EXP. COST
DEV. COST
CAP. COST
I.R.R.
T/D
2000
4000
8000


METAL: CuPbZn
BLOCK N° 5
GRADE
ENV. COST
TRAN. COST
MIL. COST.
FACTOR VALUE: CR OR
● ○ = 1.1
▲ △ = 1.0
■ □ = 0.9
Fig. 175b
I.R.R.
T/D

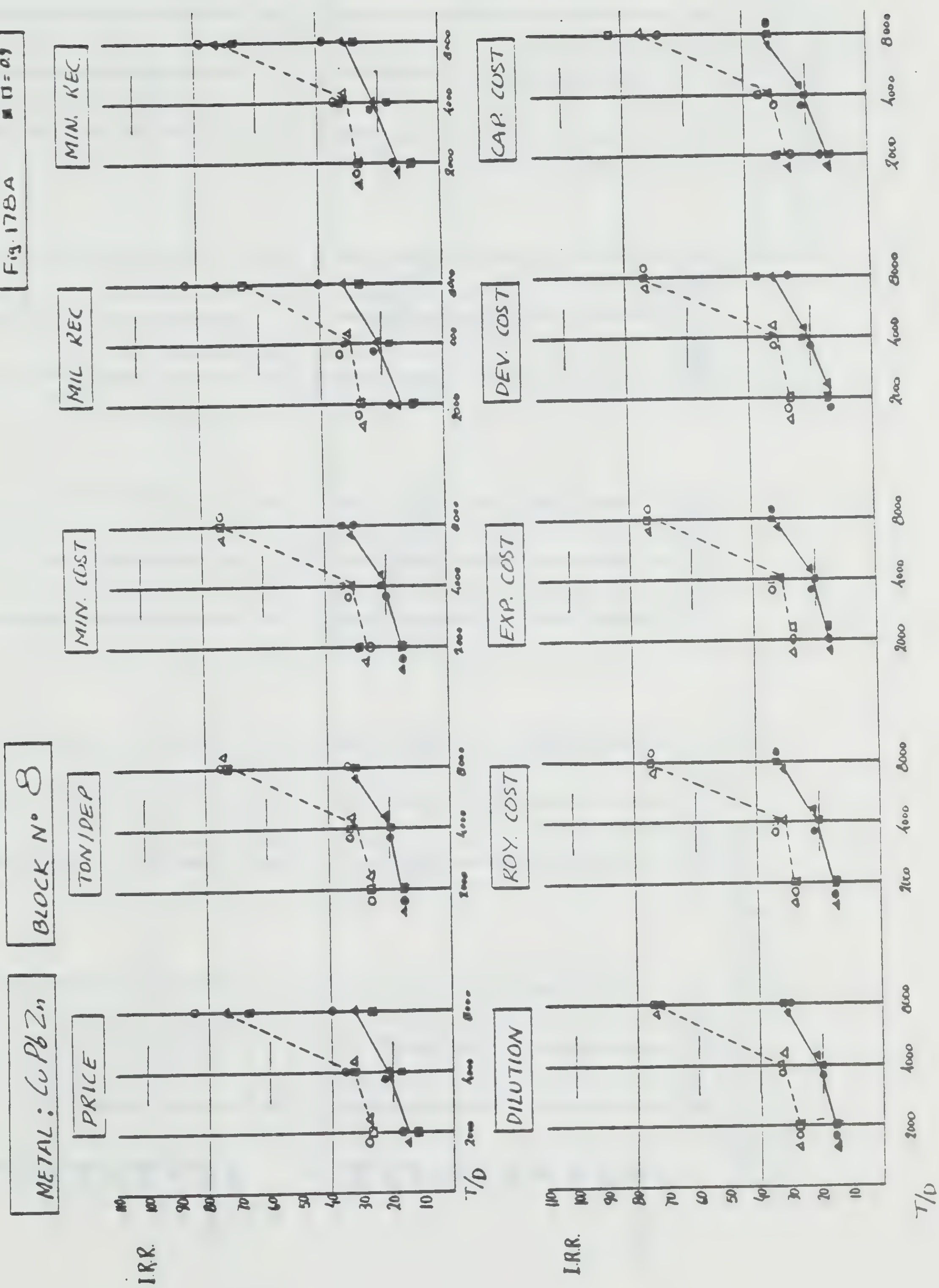

METAL: Cu Pb Zn
BLOCK N° 6
FACTOR VALUE: C.F. O.P. ● ○ = 1.1 ▲ △ = 1.0 ■ □ = 0.9
Fig. 176A
PRICE
TON/DEP
Min. CST.
Mil. Rec.
Min Rec.
DILUTION
Roy. Cst.
Exp Cst.
Dev. Cst.
Cap. Cst.
I.R.R.
50
45
40
35
30
25
20
15
10
5
T/D
2000
4000
8000

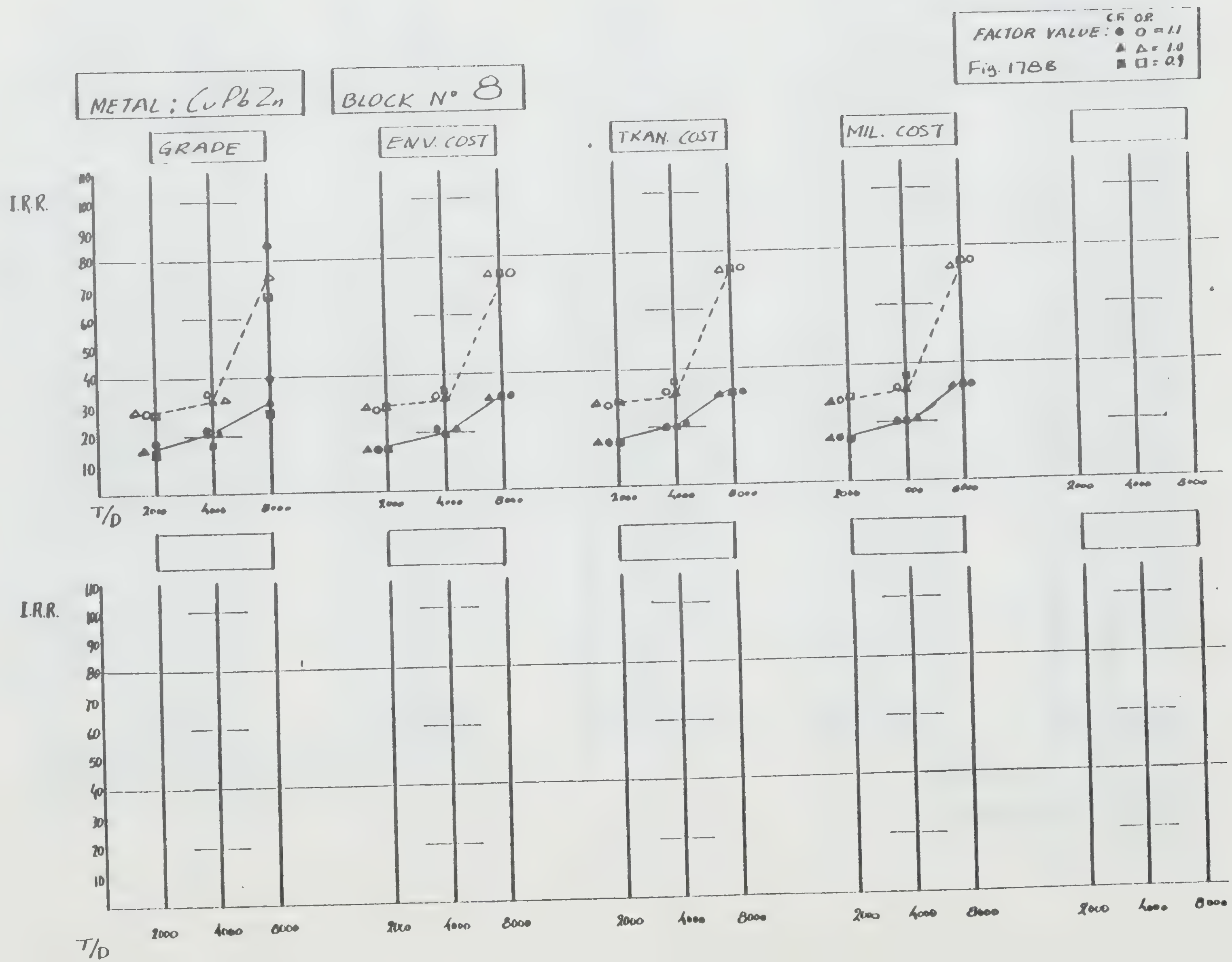

METAL : Cu Pb Zn
BLOCK N° 6
FACTOR VALUE: C.F. O.P. ● ○ = 1.1 ▲ △ = 1.0 ■ □ = 0.9
Fig. 176 B
Grade
Env. Cost
Tran Cost
Mil. Cost.
I.R.R.
50
45
40
35
30
25
20
15
10
5
T/D
2000
4000
8000

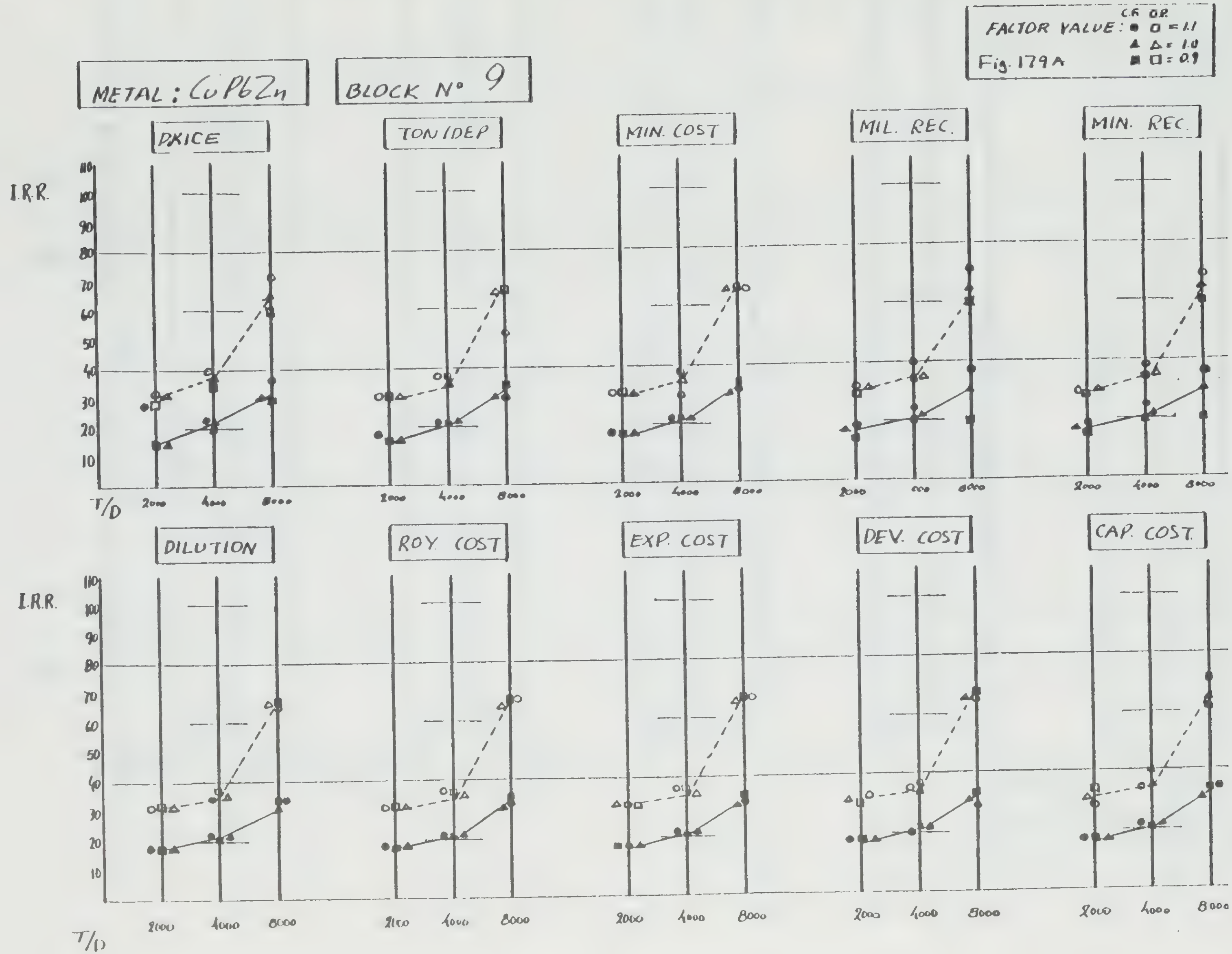

METAL: Cu Pb Zn
BLOCK N° 7
FACTOR VALUE: C.R. O.R. ● ○ = 1.1 ▲ △ = 1.0 ■ □ = 0.9
Fig. 177A
PRICE
TON/DEP
Min. CST.
Mil. Rec.
Min Rec.
DILUTION
Roy. Cst.
Exp Cst.
Dev. Cst.
Cap. Cst.
I.R.R.
T/D



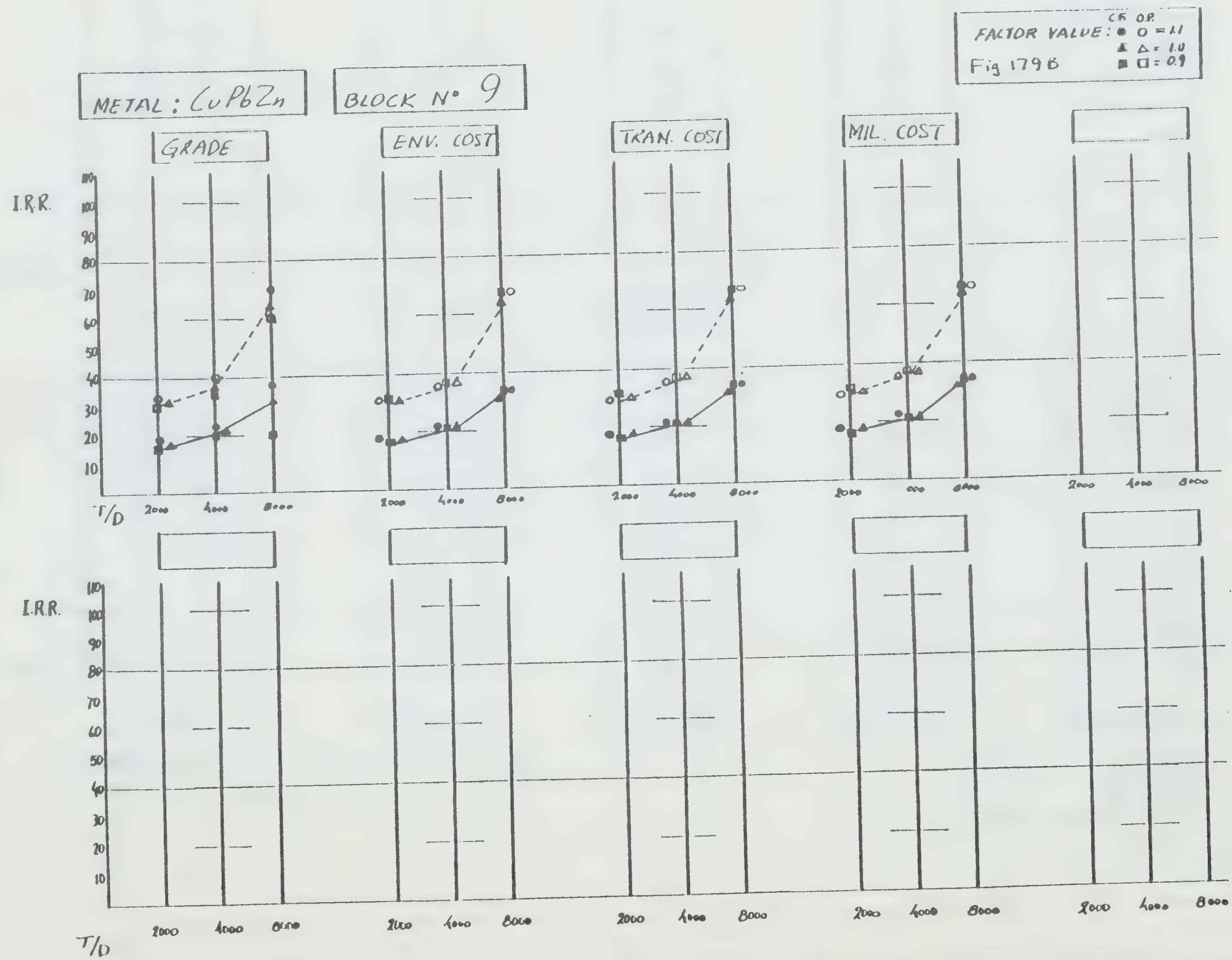
METAL: Cu Pb Zn
BLOCK N° 7
FACTOR VALUE: C.F. O.P. ● ○ = 1.1 ▲ △ = 1.0 ■ □ = 0.9
Fig. 177B
Grade
Env. Cost
Tran Cost
Mil Cost
I.R.R.
T/D


METAL: CuPbZn
BLOCK N° 8
FACTOR VALUE: C.F. OR
● ○ = 1.1
▲ △ = 1.0
■ □ = 0.9
Fig. 17BA
PRICE
TON/DEP
MIN. COST
MIL REC
MIN. REC.
DILUTION
ROY. COST
EXP. COST
DEV. COST
CAP. COST
I.R.R.
T/D

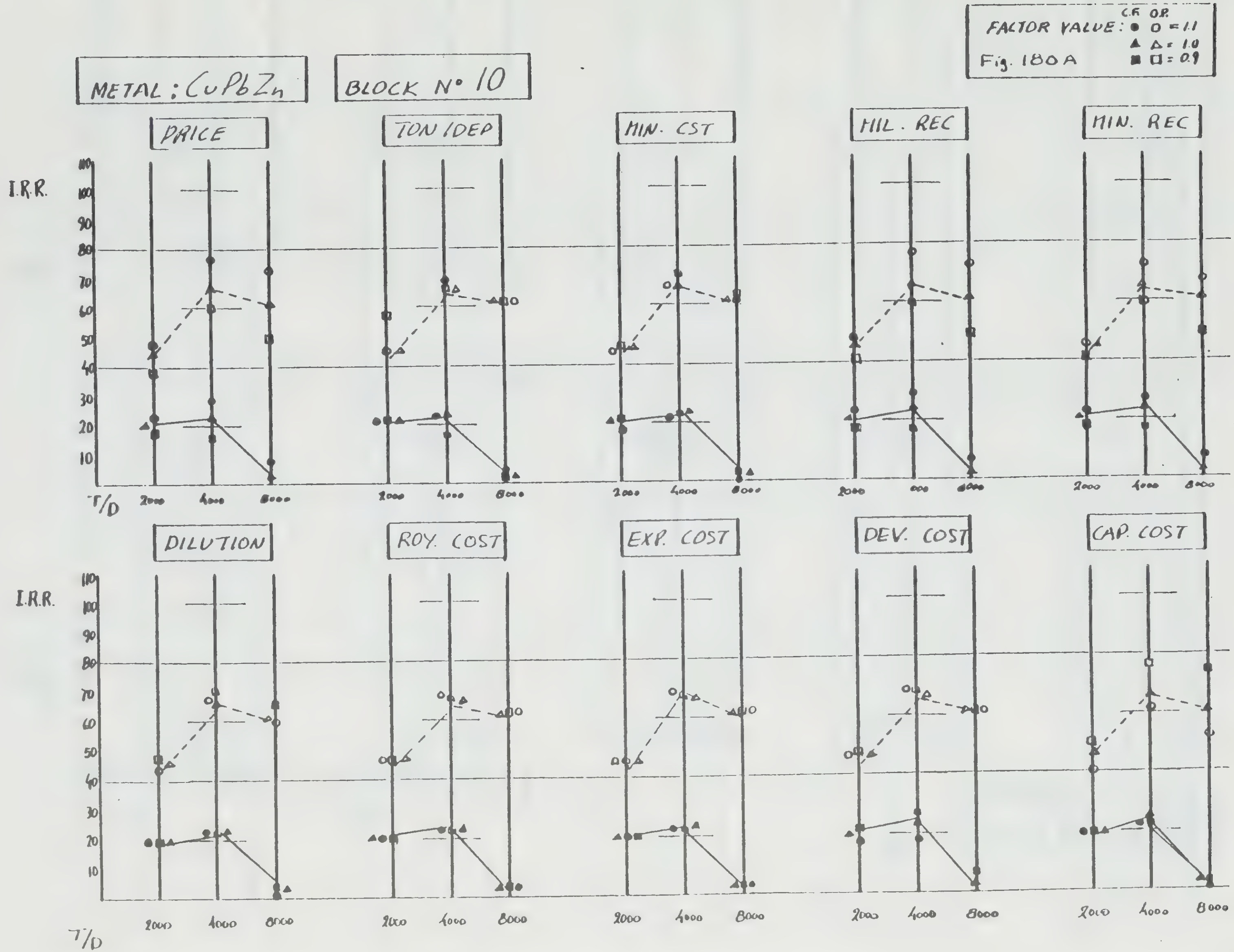

METAL : CuPbZn
BLOCK N° 8
FACTOR VALUE : CR ● ▲ ■ OR ○ = 1.1 △ = 1.0 □ = 0.9
Fig. 178B
GRADE
ENV. COST
TRAN. COST
MIL. COST
I.R.R.
T/D
2000
4000
8000

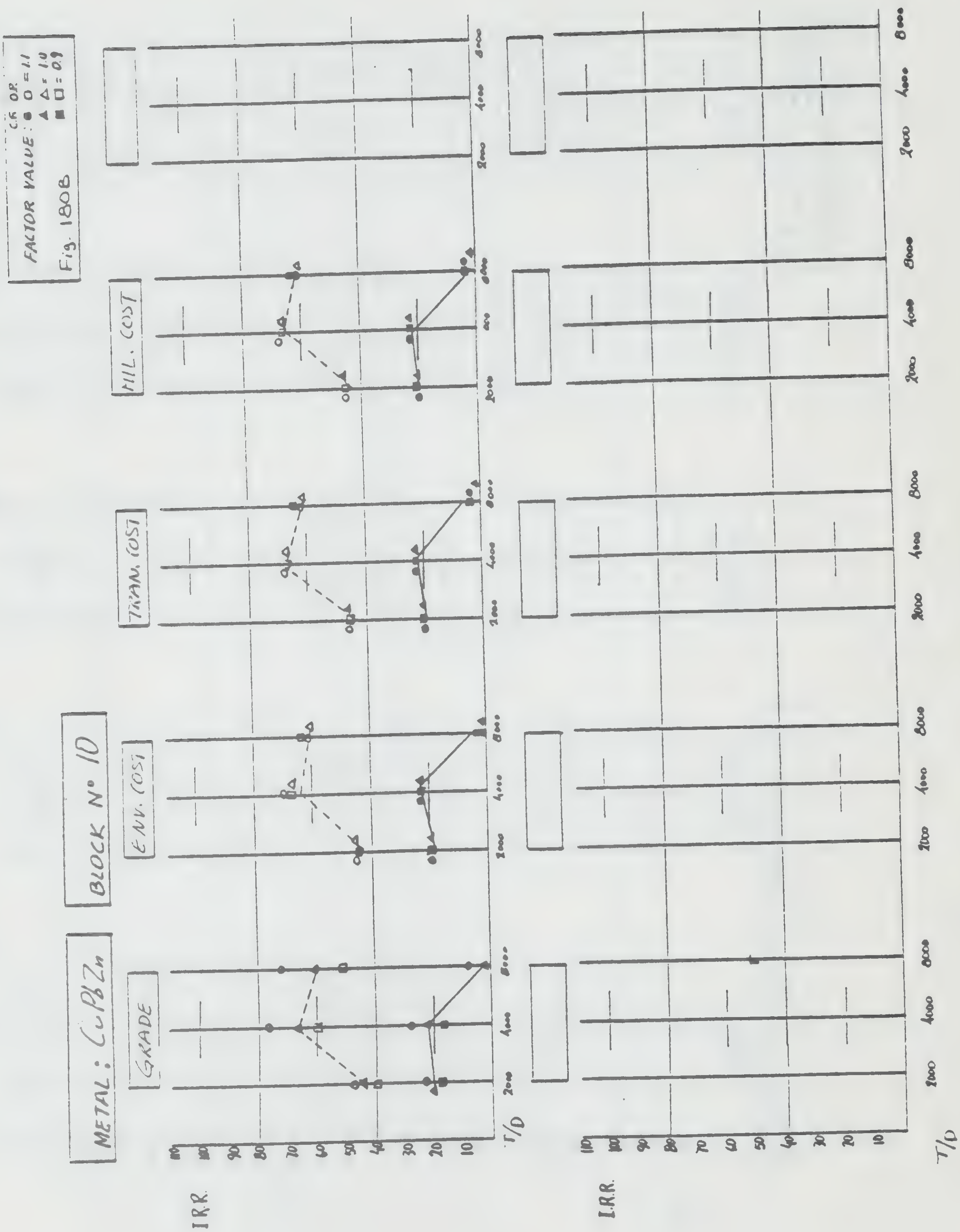


METAL : CuPbZn
BLOCK N° 9
FACTOR VALUE : C.F. O.P. ● ○ = 1.1 ▲ △ = 1.0 ■ □ = 0.9
Fig. 179A
PRICE
TON/DEP
MIN. COST
MIL. REC.
MIN. REC.
DILUTION
ROY. COST
EXP. COST
DEV. COST
CAP. COST
I.R.R.
T/D

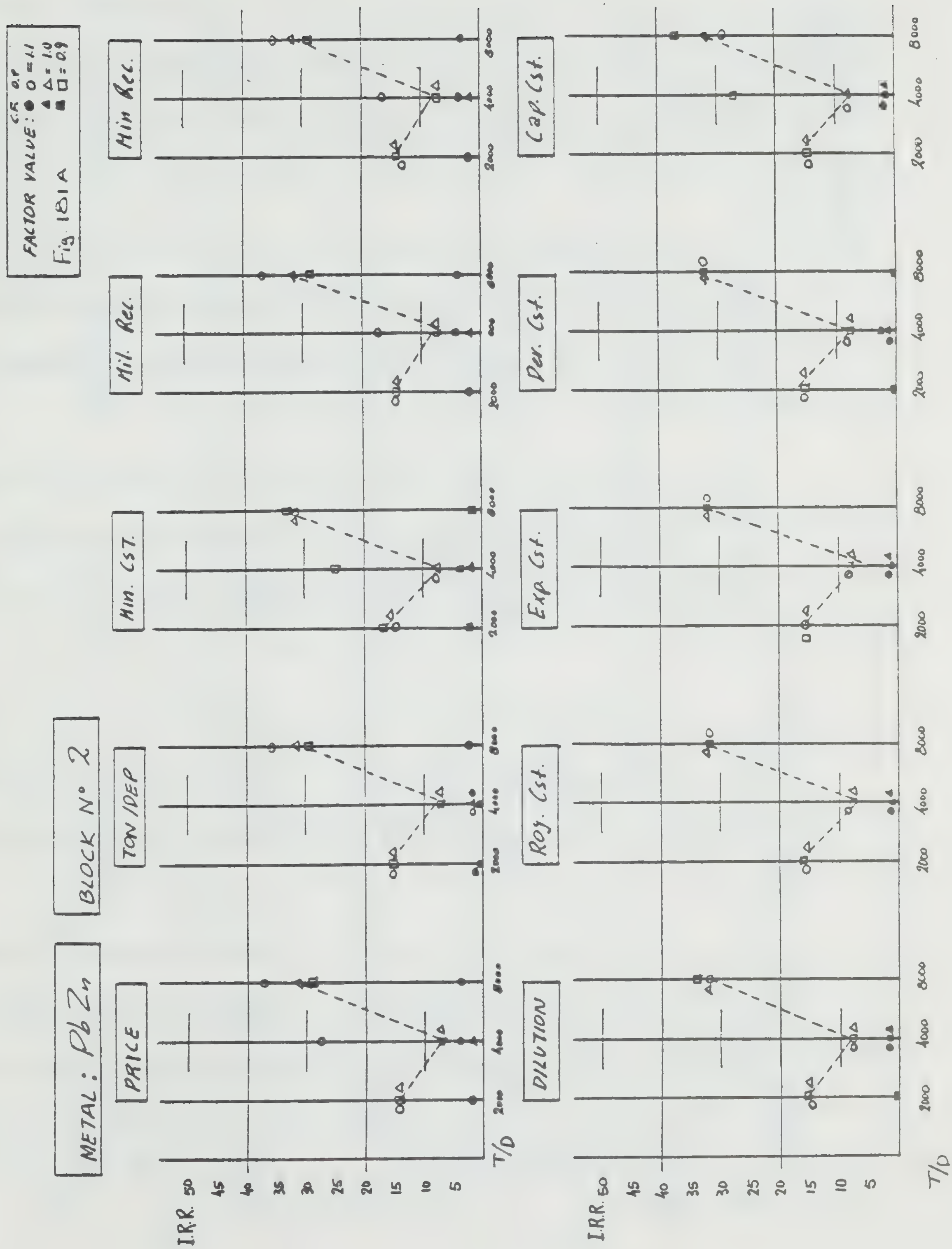


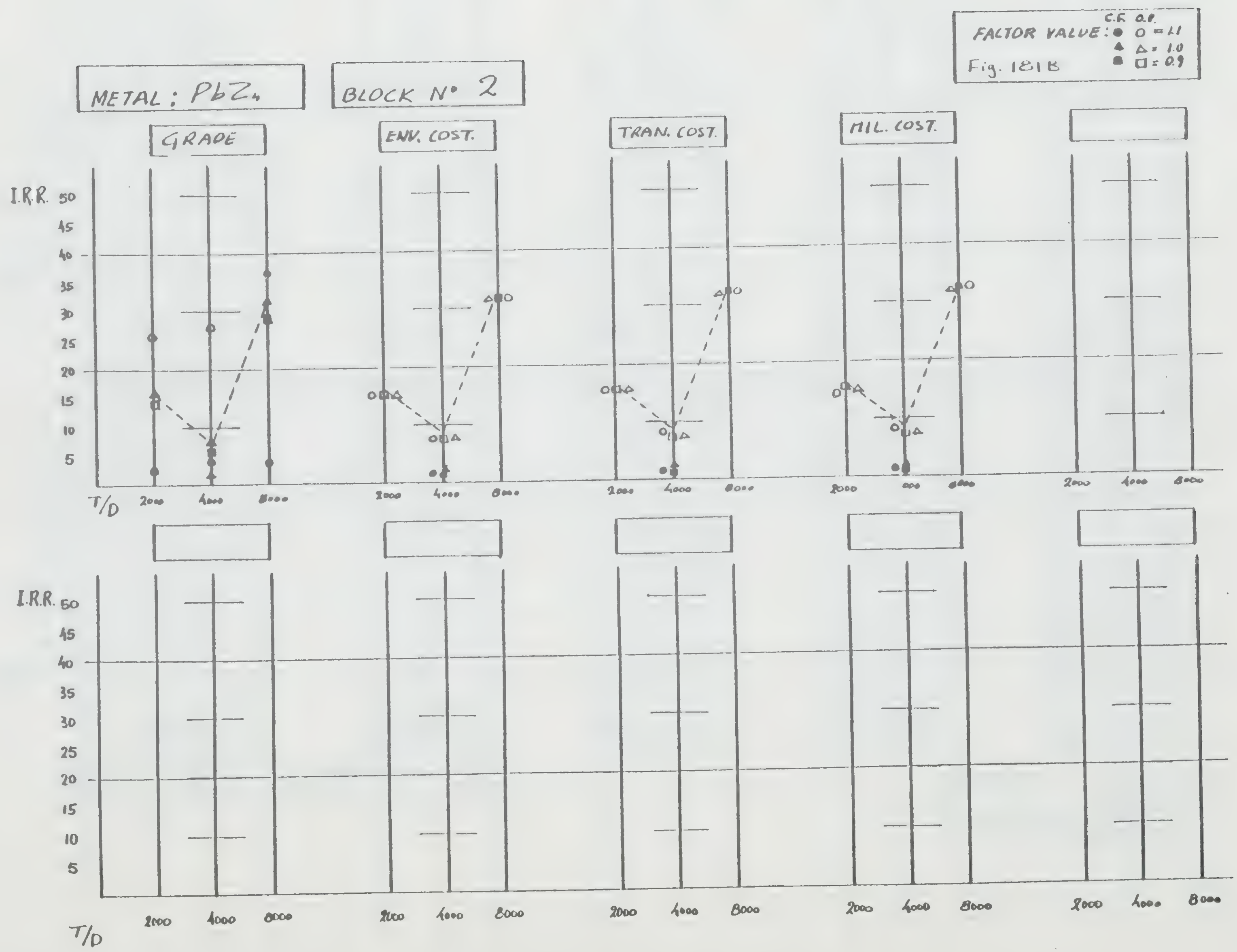
METAL : CuPbZn
BLOCK N° 9
FACTOR VALUE : CR OR ● ○ = 1.1 ▲ △ = 1.0 ■ □ = 0.9
Fig 179b
GRADE
ENV. COST
TRAN. COST
MIL. COST
I.R.R.
T/D


METAL: CuPbZn
BLOCK N° 10
FACTOR VALUE: C.F. O.P. ● ○ = 1.1 ▲ △ = 1.0 ■ □ = 0.9
Fig. 180A
PRICE
TON/DEP
MIN. CST
MIL. REC
MIN. REC
DILUTION
ROY. COST
EXP. COST
DEV. COST
CAP. COST
I.R.R.
T/D
2000
4000
8000

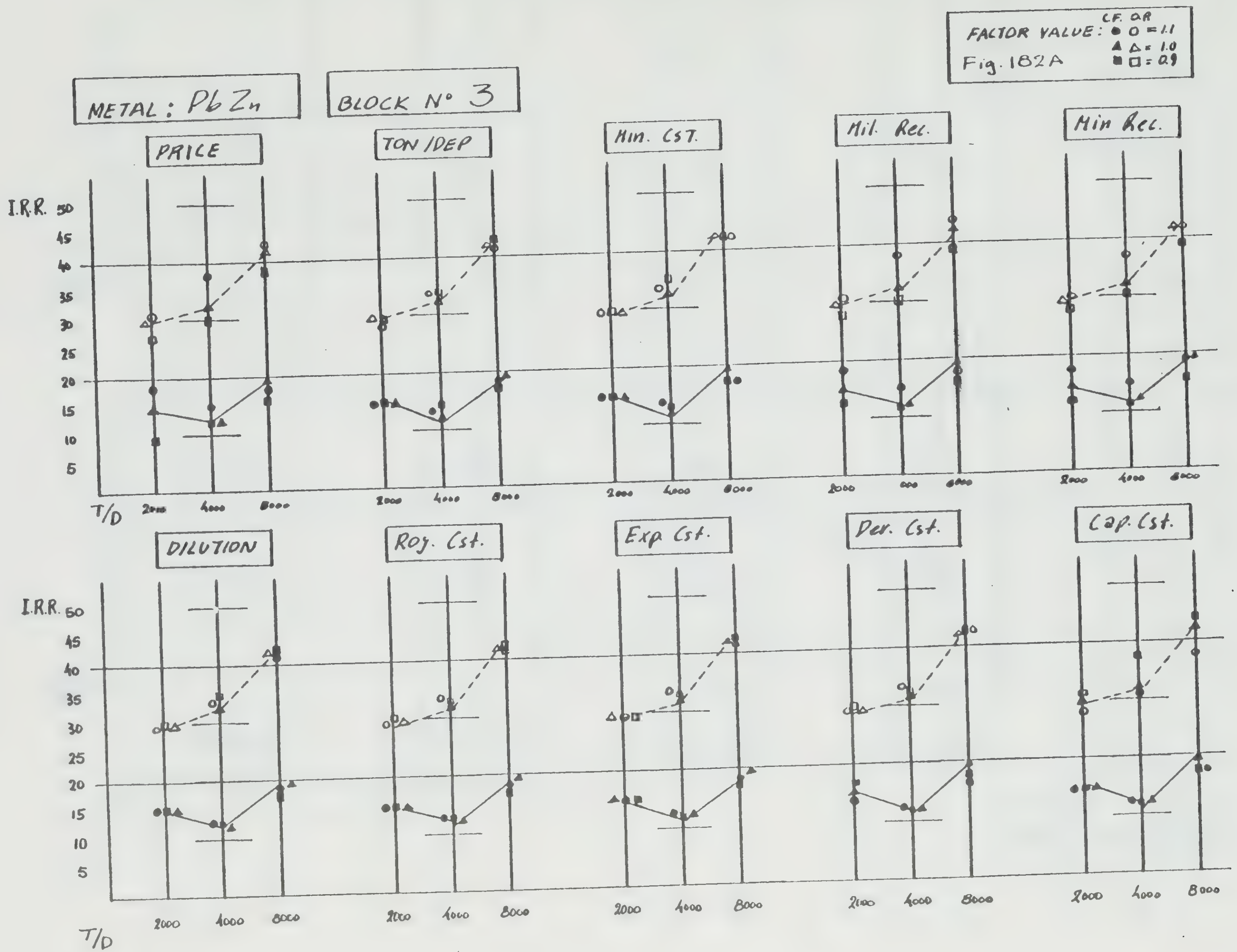


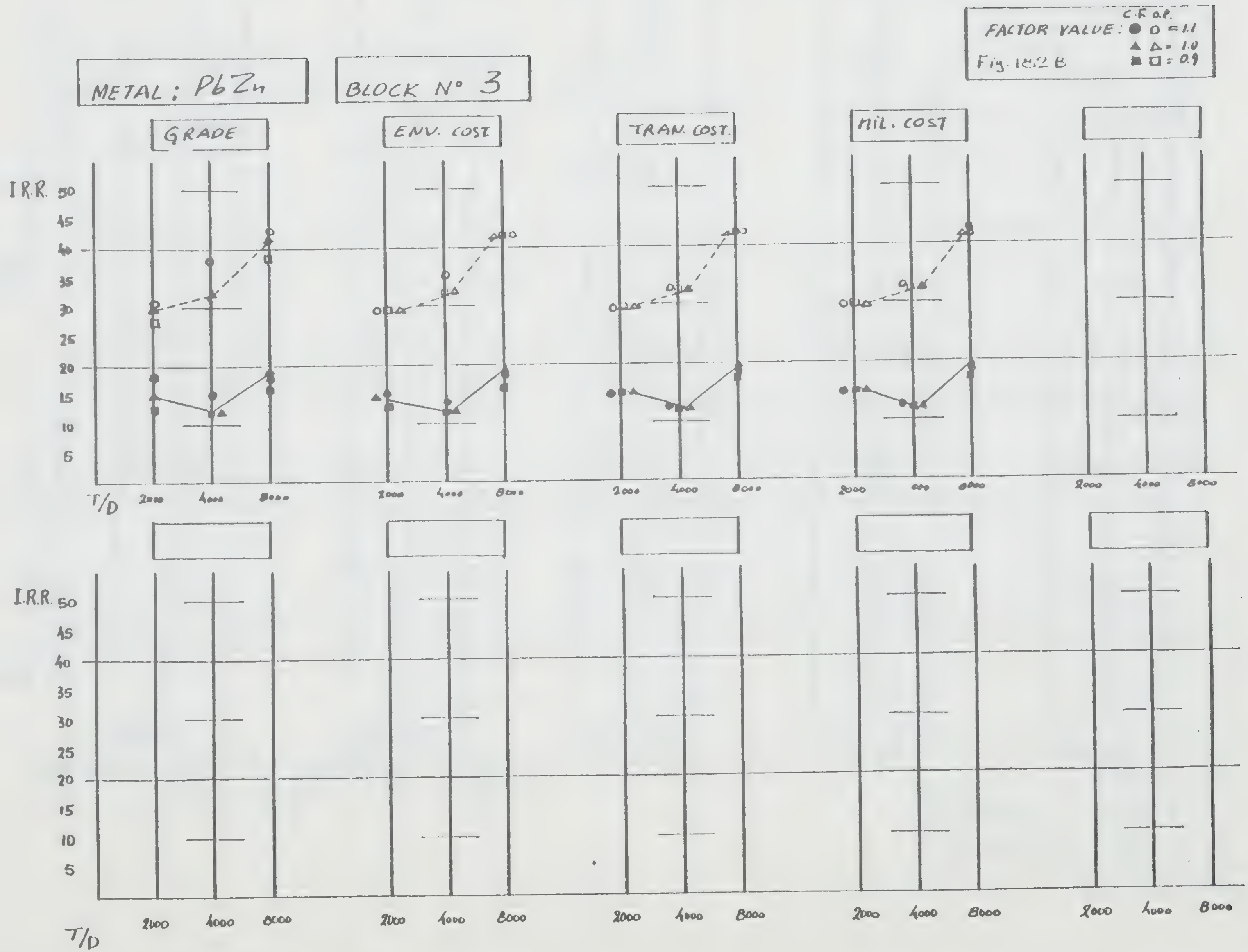
METAL: CuPbZn
BLOCK N° 10
FACTOR VALUE: C.R. O.P.
● ○ = 1.1
▲ △ = 1.0
■ □ = 0.9
Fig. 180B
GRADE
ENV. COST
TRAN. COST
MIL. COST
I.R.R.
T/D

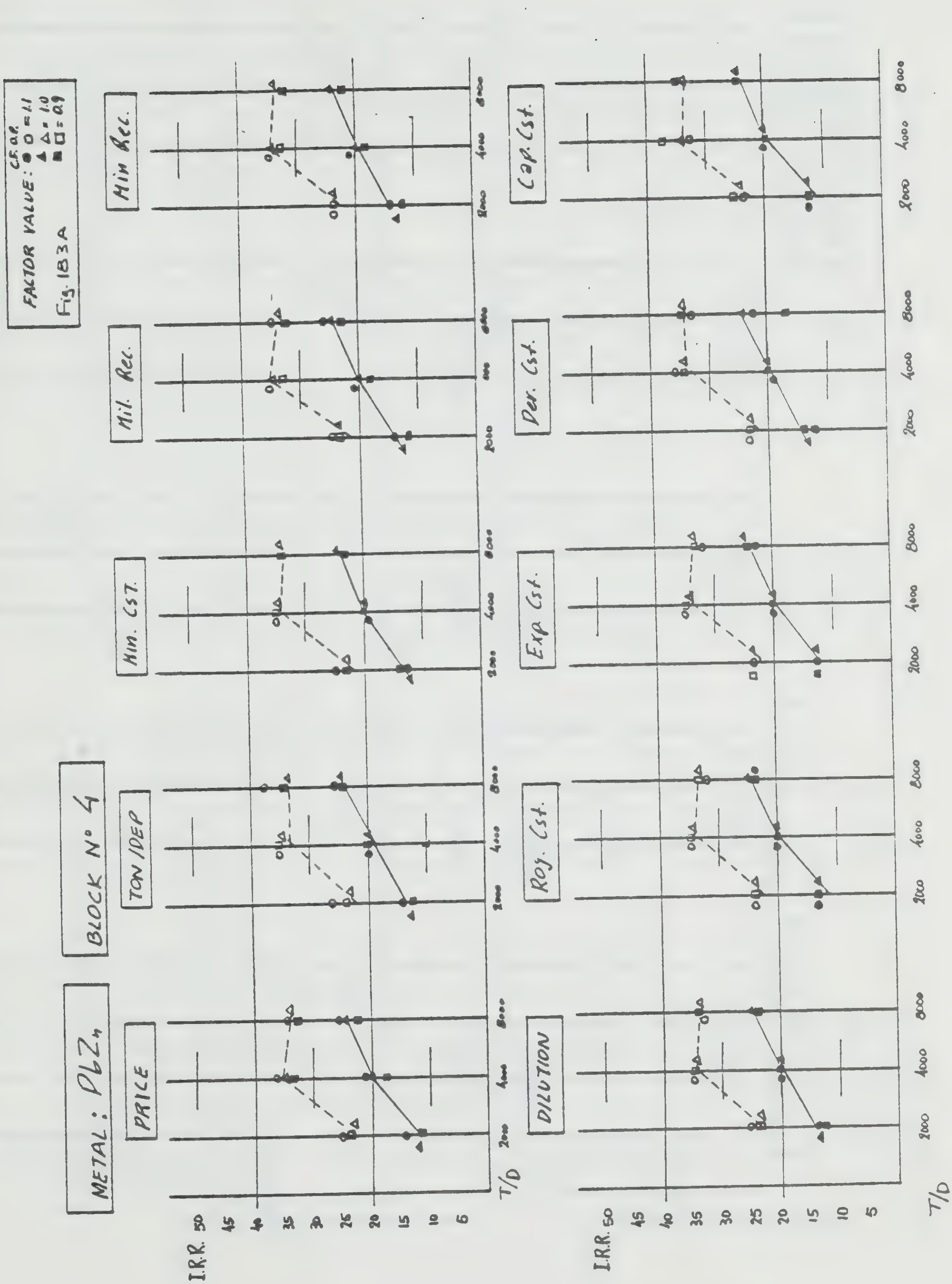

METAL : Pb Zn
BLOCK N° 2
FACTOR VALUE: C.R. 0.P ● ○ = 1.1 ▲ △ = 1.0 ■ □ = 0.9
Fig. 181 A
PRICE
TON/DEP
Min. CST.
Mil. Rec.
Min Rec.
DILUTION
Roy. Cst.
Exp. Cst.
Per. Cst.
Cap. Cst.
I.R.R.
T/D



METAL : PbZ4
BLOCK N° 2
FACTOR VALUE:
C.F. O.P.
● ○ = 1.1
▲ △ = 1.0
■ □ = 0.9
Fig. 181B
GRADE
ENV. COST.
TRAN. COST.
MIL. COST.
I.R.R.
50
45
40
35
30
25
20
15
10
5
T/D
2000
4000
8000


FACTOR VALUE: CF. OR ● ○ = 1.1 ▲ △ = 1.0 ■ □ = 0.9
Fig. 182A
METAL: Pb Zn
BLOCK N° 3
PRICE
TON/DEP
Min. CST.
Mil. Rec.
Min Rec.
DILUTION
Roy. Cst.
Exp Cst.
Der. Cst.
Cap. Cst.
I.R.R.
T/D
2000
4000
8000
50
45
40
35
30
25
20
15
10
5


METAL: PbZn
BLOCK N° 3
FACTOR VALUE: C.F. ap. ● ○ = 1.1 ▲ △ = 1.0 ■ □ = 0.9
Fig. 18.2 B
GRADE
ENV. COST.
TRAN. COST.
MIL. COST
I.R.R.
50
45
40
35
30
25
20
15
10
5
T/D
2000
4000
8000


METAL: PbZn
BLOCK N° 4
FACTOR VALUE: C.F. O.R.
● ○ = 1.1
▲ △ = 1.0
■ □ = 0.9
Fig. 1B3A
PRICE
TON/DEP
Min. Cst.
Mil. Rec.
Min Rec.
DILUTION
Roy. Cst.
Exp Cst.
Per. Cst.
Cap. Cst.
I.R.R.
T/D
2000
4000
8000
50
45
40
35
30
25
20
15
10
5

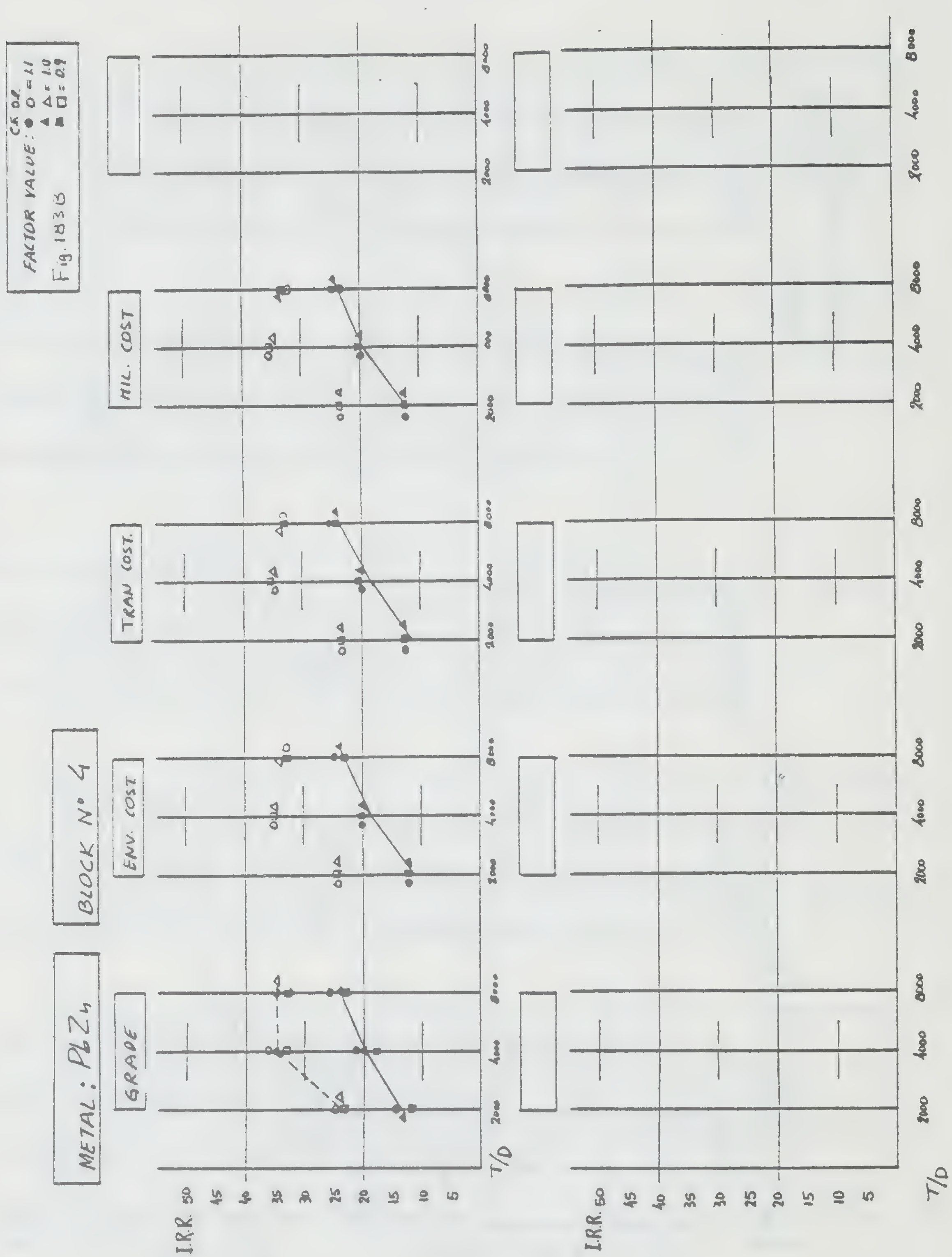
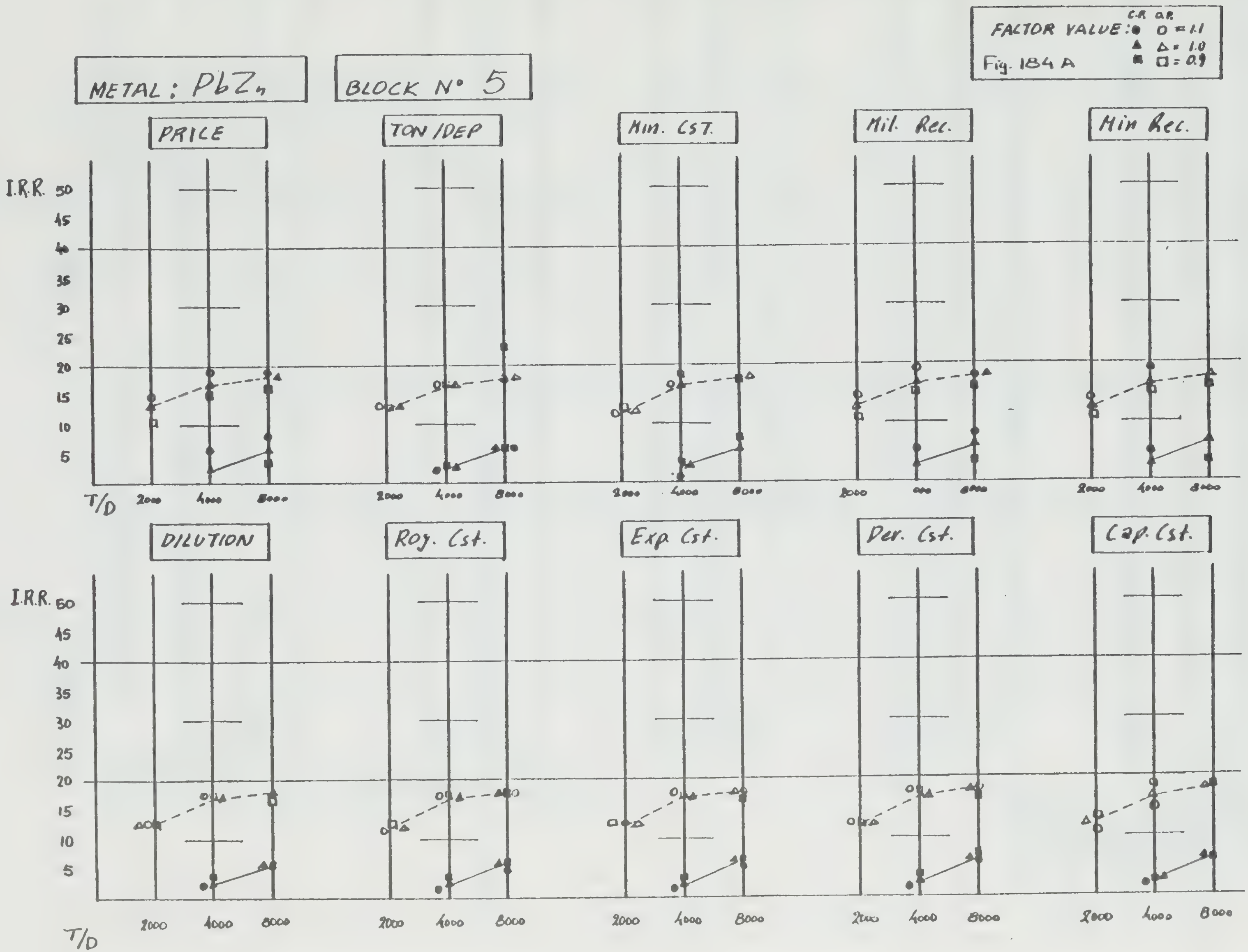
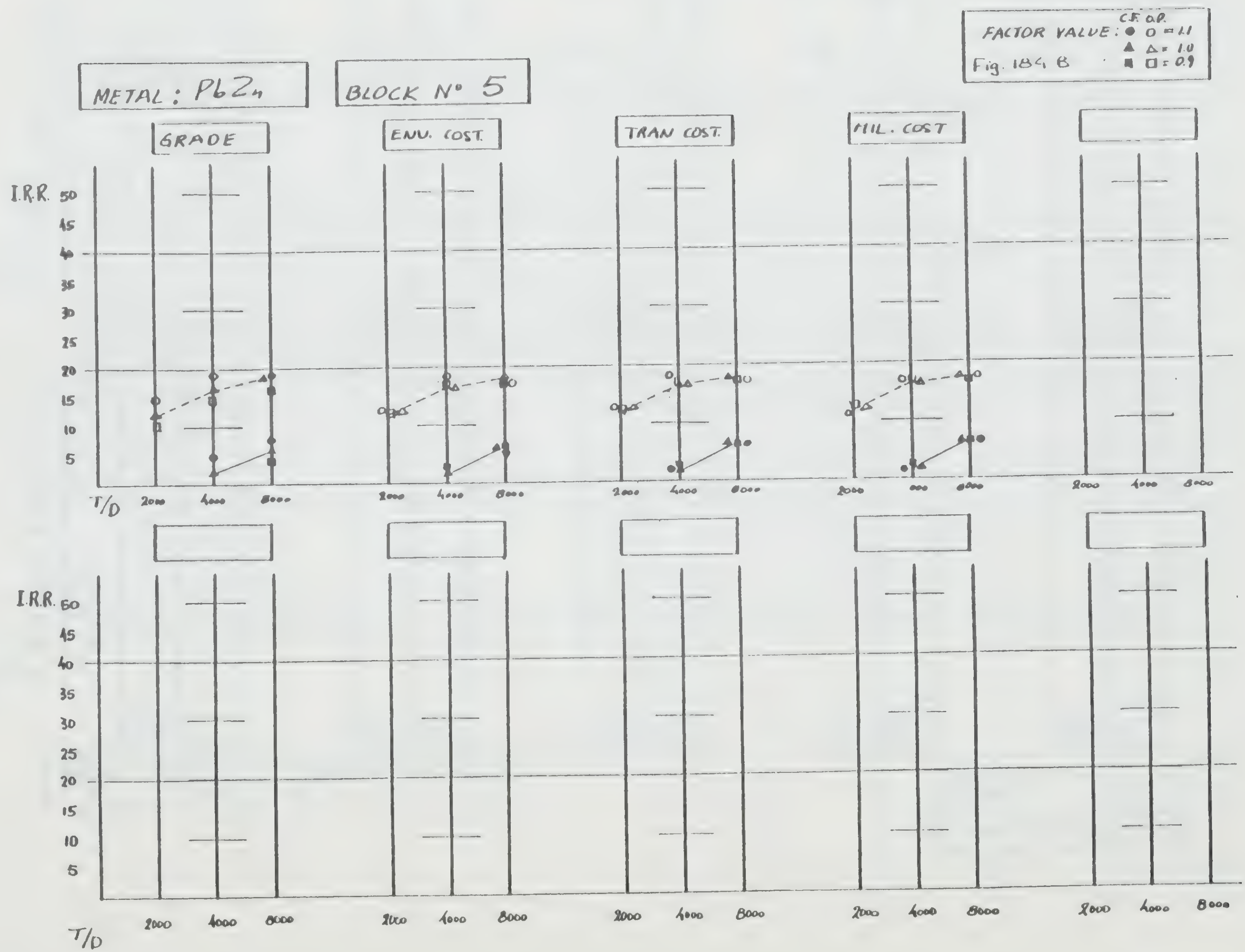
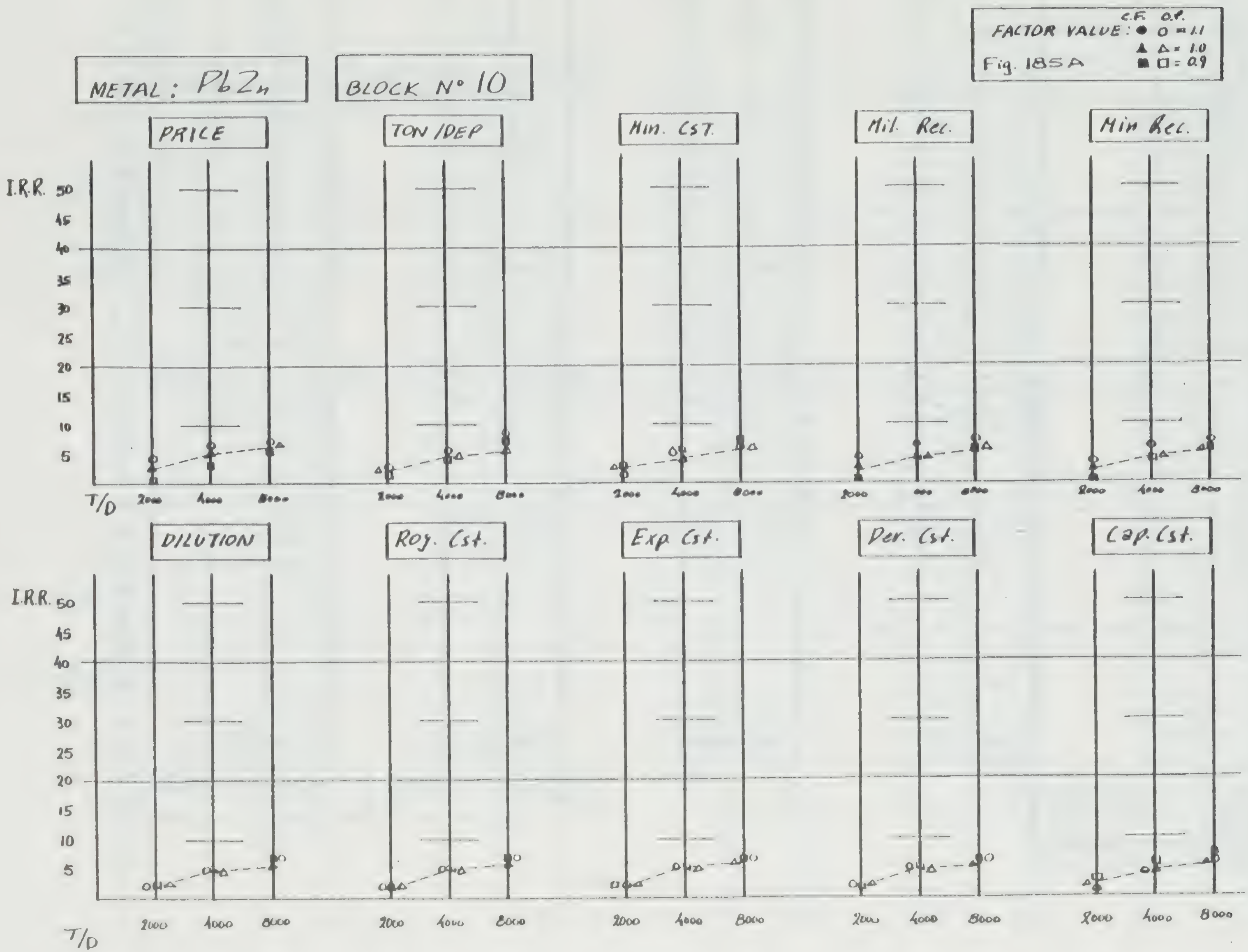
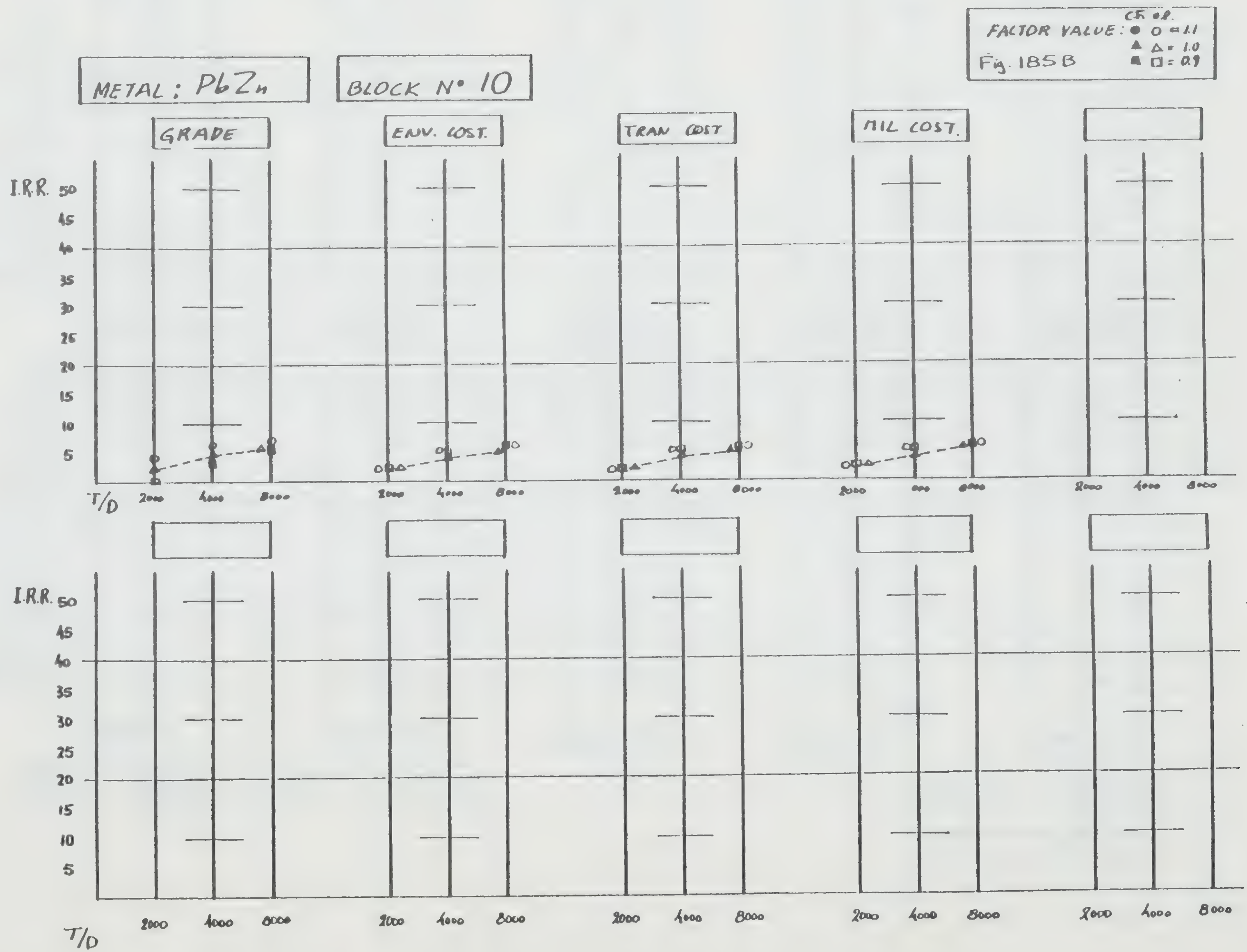

METAL : PbZn
BLOCK N° 4
FACTOR VALUE : C.K. O.P. ● O = 1.1 ▲ △ = 1.0 ■ □ = 0.9
Fig. 183B
GRADE
ENV. COST
TRAN COST.
MIL. COST
I.R.R.
T/D

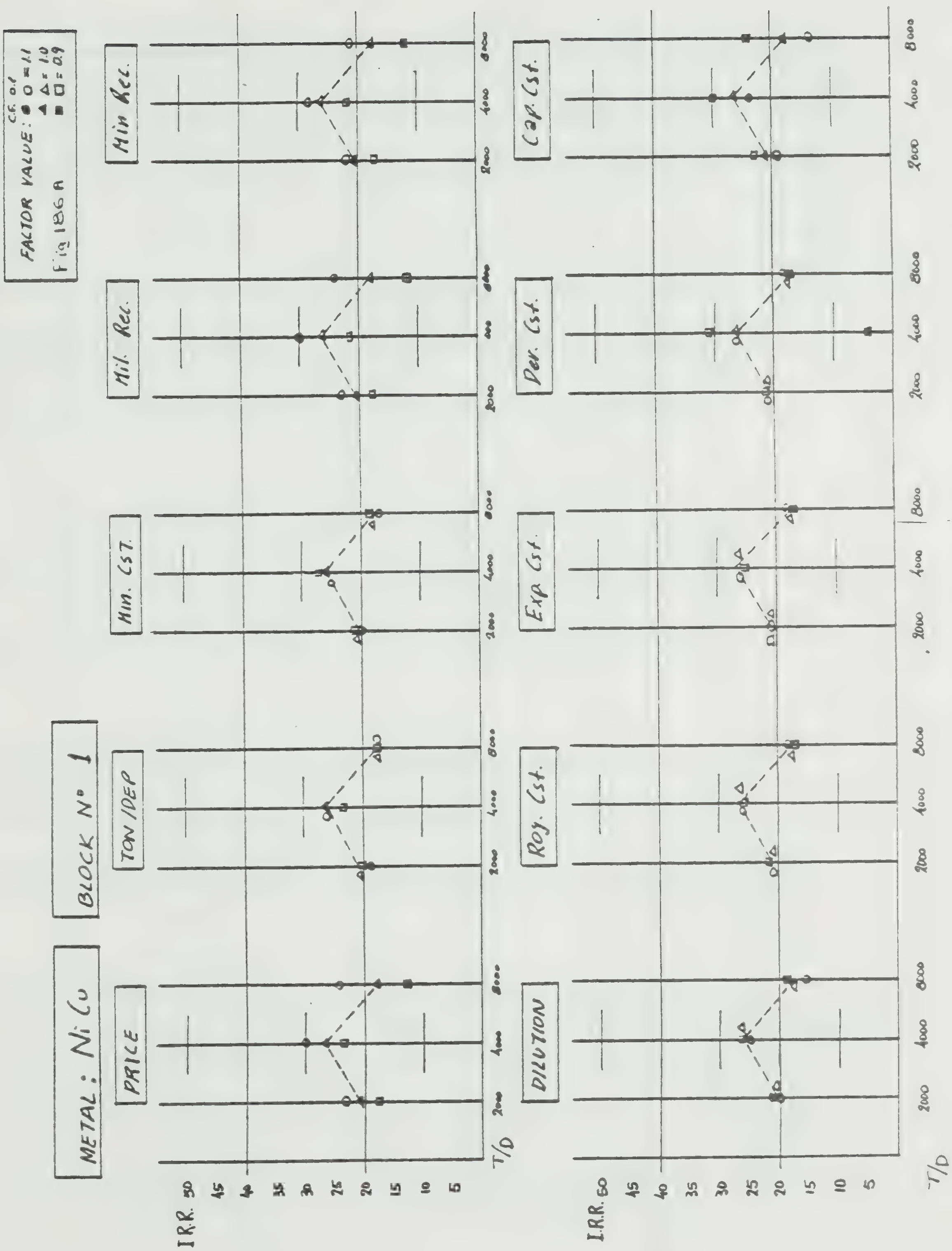
Fig. 184 A


METAL : PbZn
BLOCK N° 5
FACTOR VALUE: C.R. O.R. ● ○ = 1.1 ▲ △ = 1.0 ■ □ = 0.9
PRICE
TON/DEP
Min. CST.
Mil. Rec.
Min Rec.
DILUTION
Roy. Cst.
Exp Cst.
Per. Cst.
Cap. Cst.
I.R.R.
T/D
2000
4000
8000


METAL : PbZn
BLOCK N° 5
FACTOR VALUE: C.F. O.P. ● ○ = 1.1 ▲ △ = 1.0 ■ □ = 0.9
Fig. 184 B
GRADE
ENV. COST.
TRAN COST.
MIL. COST
I.R.R.
50
45
40
35
30
25
20
15
10
5
T/D
2000
4000
8000


METAL : PbZn
BLOCK N° 10
FACTOR VALUE : C.F. O.P. ● O = 1.1 ▲ Δ = 1.0 ■ □ = 0.9
Fig. 185A
PRICE
TON/DEP
Min. CST.
Mil. Rec.
Min Rec.
DILUTION
Roy. Cst.
Exp Cst.
Der. Cst.
Cap. Cst.
I.R.R.
50
45
40
35
30
25
20
15
10
5
T/D
2000
4000
8000


METAL : PbZn
BLOCK N° 10
FACTOR VALUE: CF. e.p. ● ○ = 1.1 ▲ △ = 1.0 ■ □ = 0.9
Fig. 185B
GRADE
ENV. COST.
TRAN COST
MIL COST.
I.R.R.
T/D


METAL: Ni Cu
BLOCK N° 1
FACTOR VALUE: C.F. 0.1 ● ○ = 1.1 ▲ △ = 1.0 ■ □ = 0.9
Fig 186 A
PRICE
TON/DEP
Min. Cst.
Mil. Rec.
Min Rec.
DILUTION
Roy. Cst.
Exp Cst.
Per. Cst.
Cap. Cst.
I.R.R.
T/D

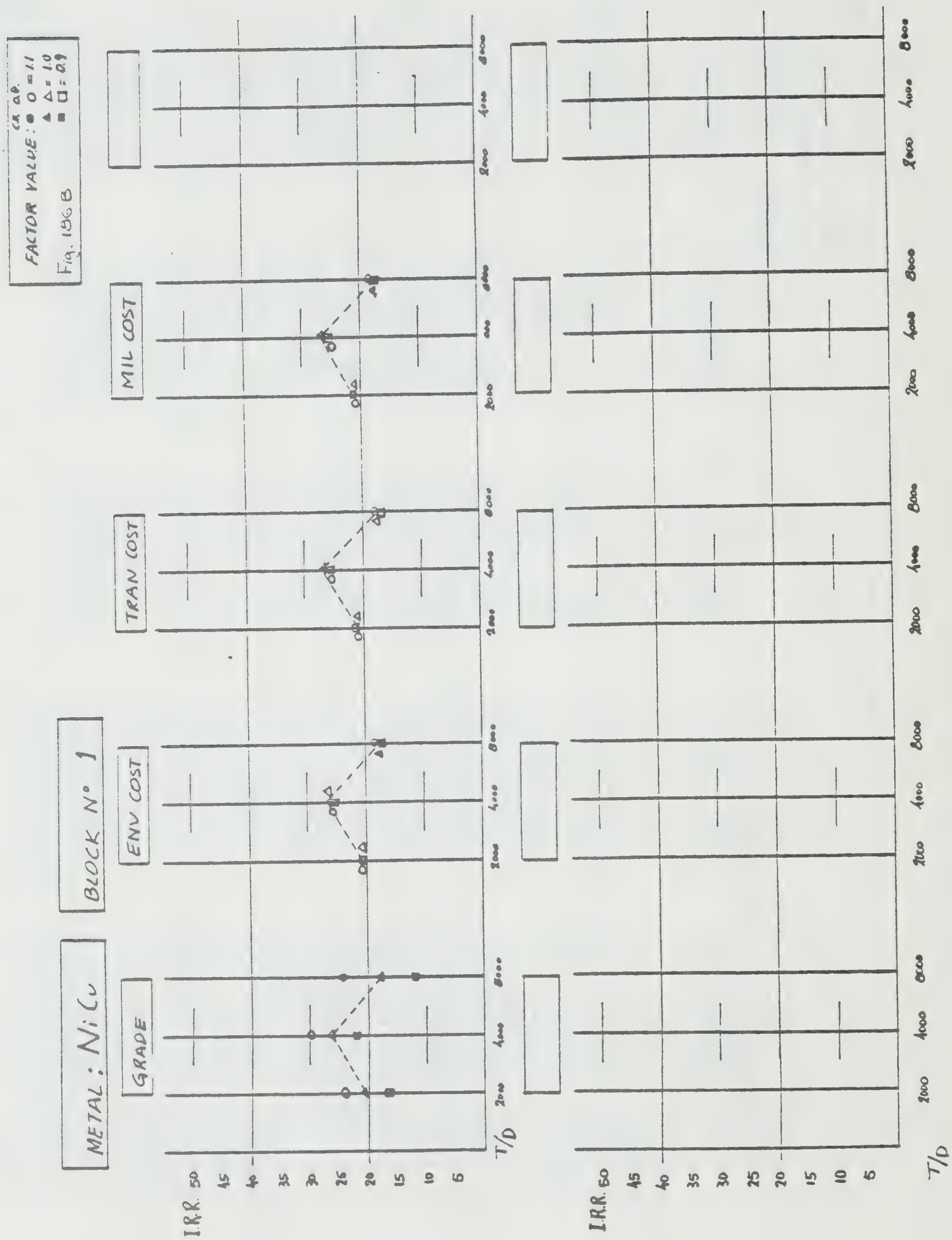
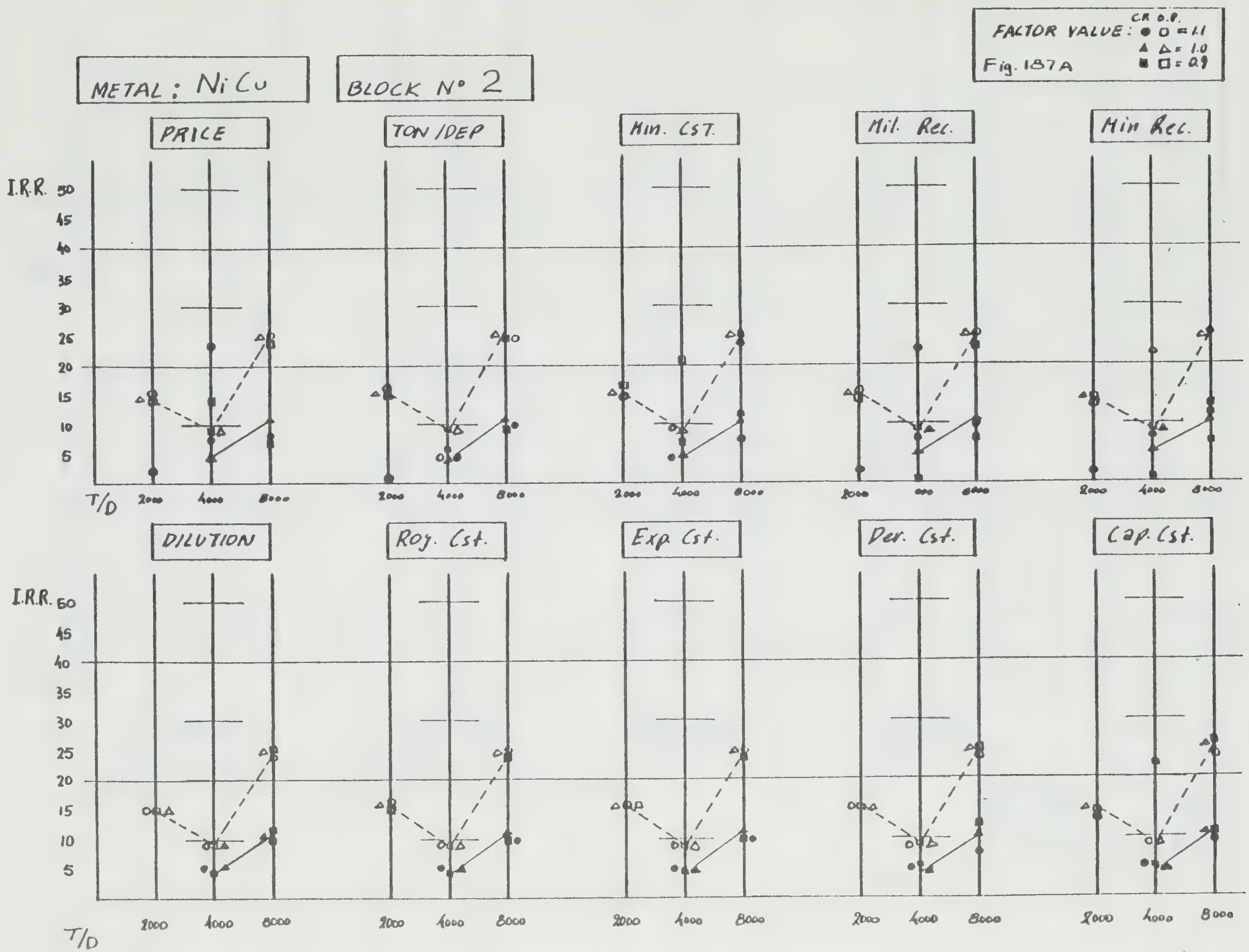

METAL : Ni Cu
BLOCK N° 1
FACTOR VALUE : ● O = 1.1
▲ Δ = 1.0
■ □ = 0.9
GRADE
ENV COST
TRAN COST
MIL COST
I.R.R.
T/D

Fig. 196 B


METAL : Ni Cu
BLOCK N° 2
FACTOR VALUE : CR O.P. ● ○ = 1.1 ▲ △ = 1.0 ■ □ = 0.9
Fig. 187A
PRICE
TON/DEP
Min. CST.
Mil. Rec.
Min Rec.
DILUTION
Roy. Cst.
Exp Cst.
Der. Cst.
Cap. Cst.
I.R.R.
T/D

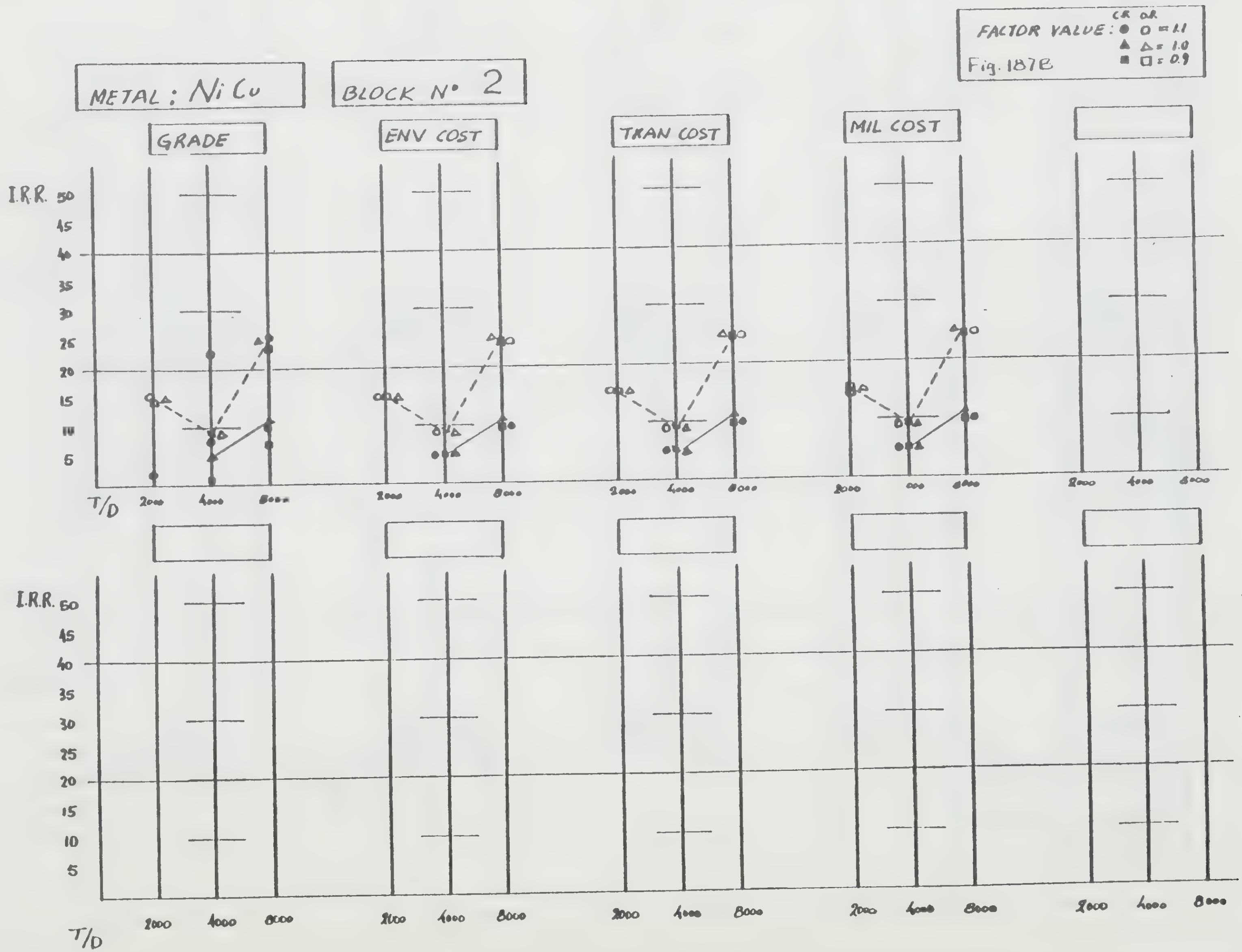
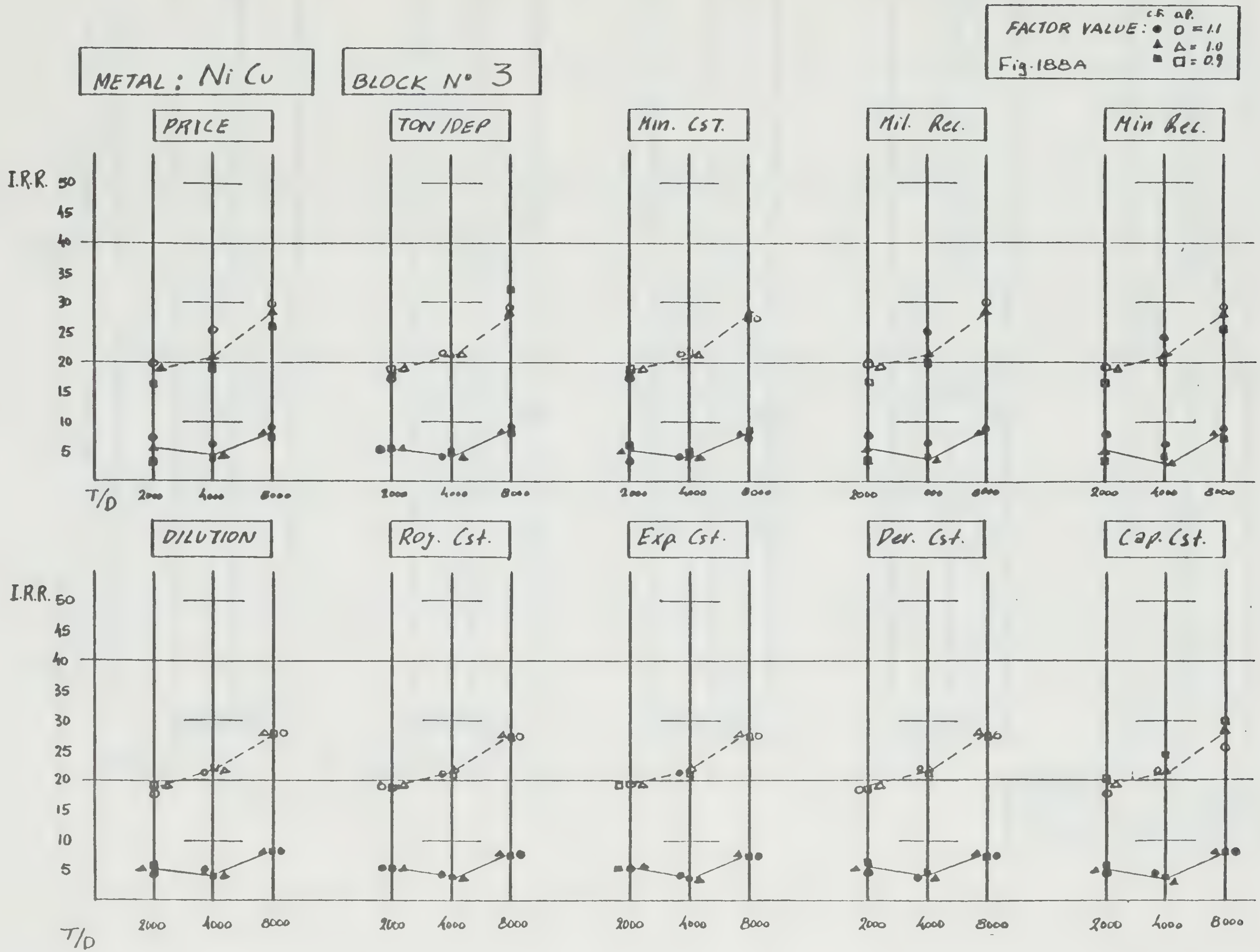
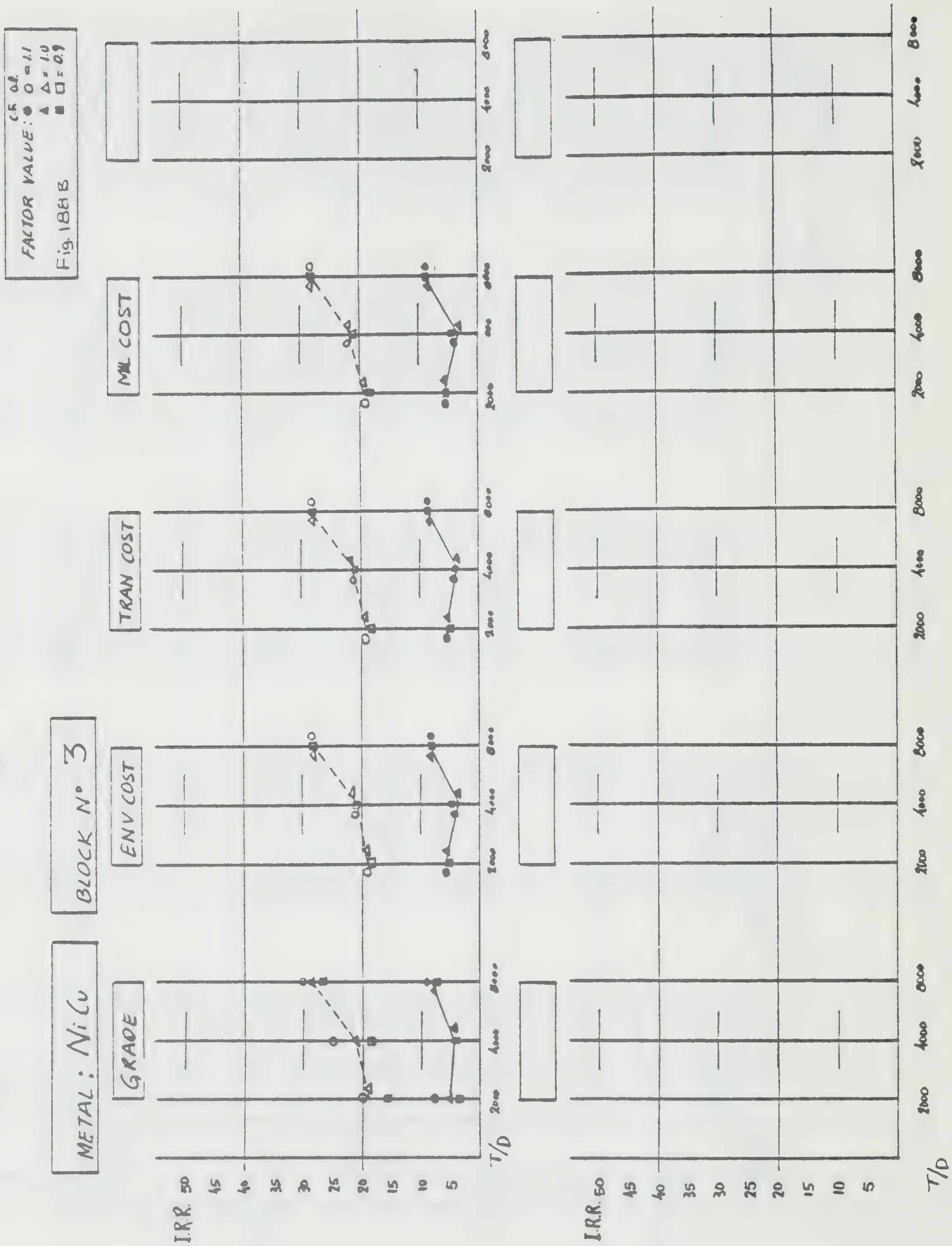
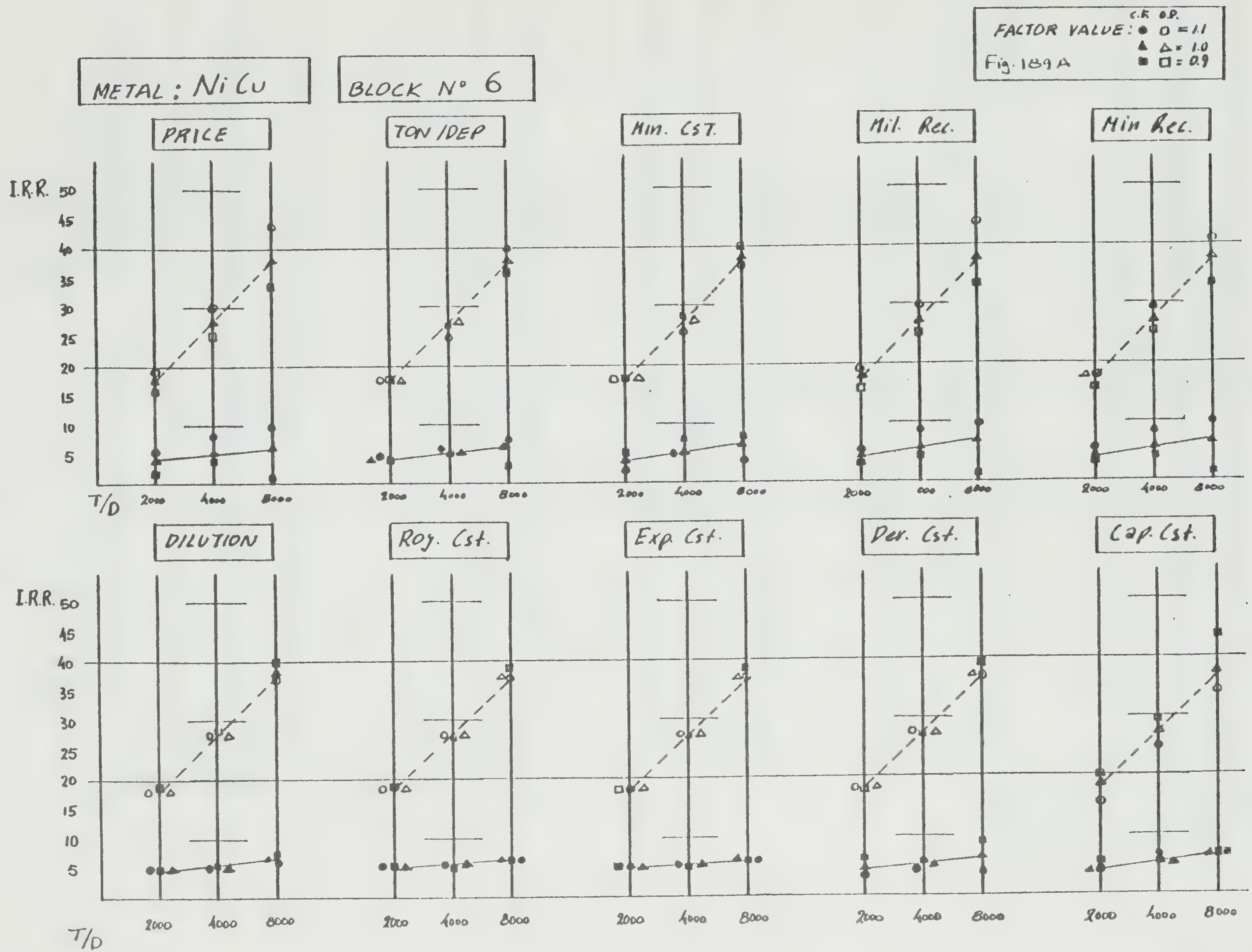
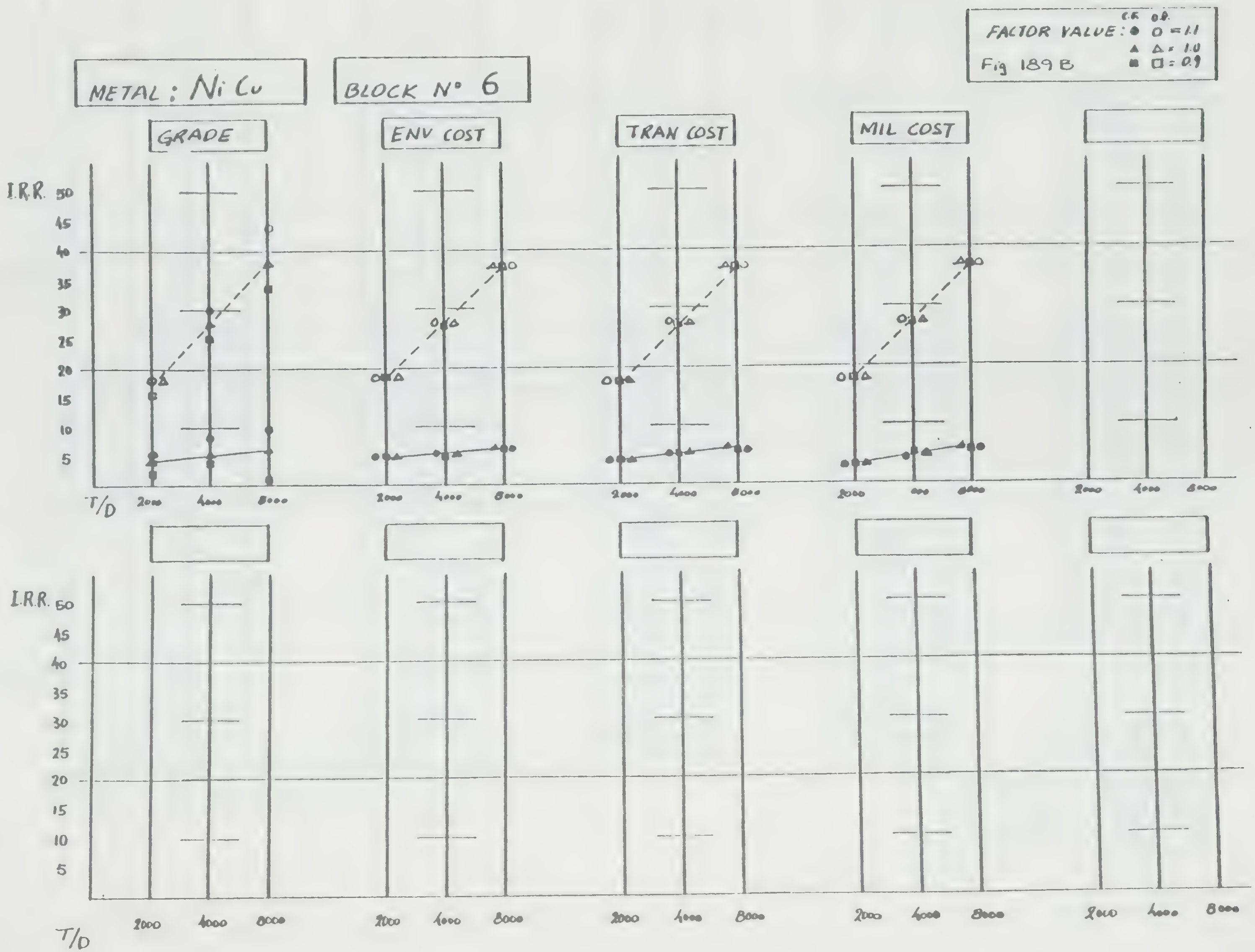

METAL : Ni Cu
BLOCK N° 2
FACTOR VALUE: CR ● OR ○ = 1.1 ▲ △ = 1.0 ■ □ = 0.9
GRADE
ENV COST
TRAN COST
MIL COST
I.R.R.
50 45 40 35 30 25 20 15 10 5
T/D
2000 4000 8000

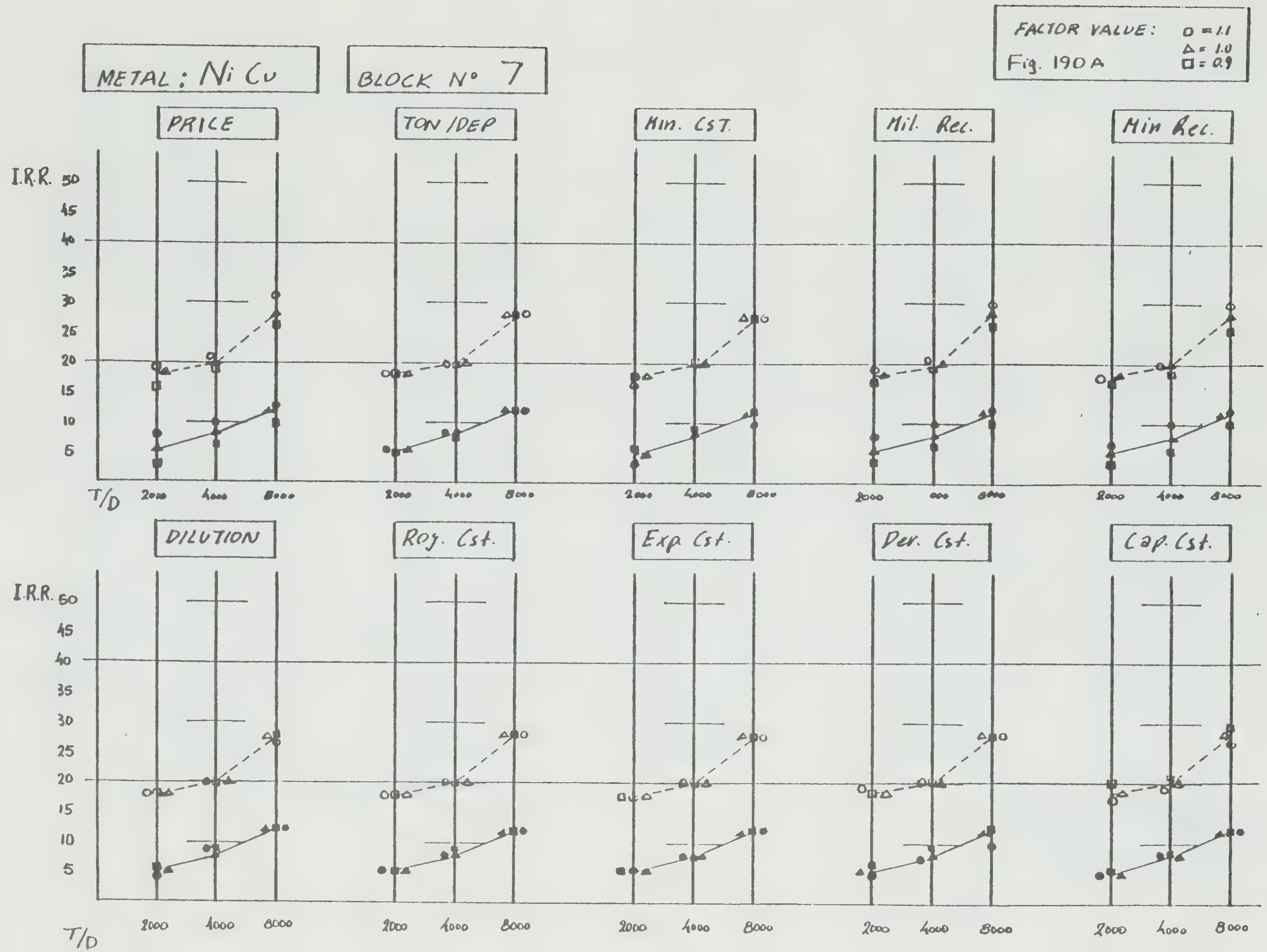
Fig. 187E

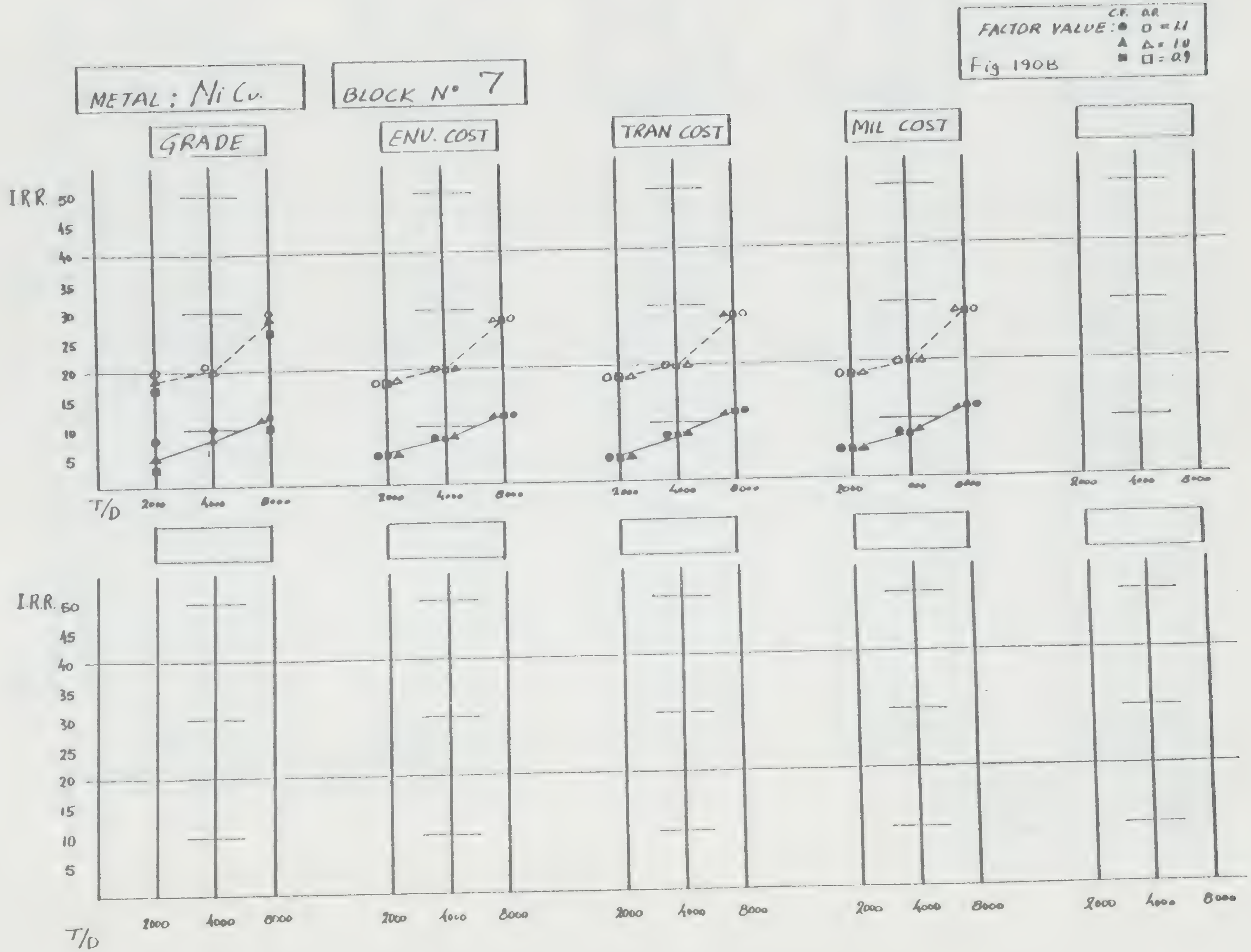

METAL : Ni Cu
BLOCK N° 3
FACTOR VALUE : c.f. a.p. ● ○ = 1.1 ▲ △ = 1.0 ■ □ = 0.9
Fig. 188A
PRICE
TON/DEP
Min. CST.
Mil. Rec.
Min Rec.
DILUTION
Roy. Cst.
Exp Cst.
Dev. Cst.
Cap. Cst.
I.R.R.
50
45
40
35
30
25
20
15
10
5
T/D
2000
4000
8000

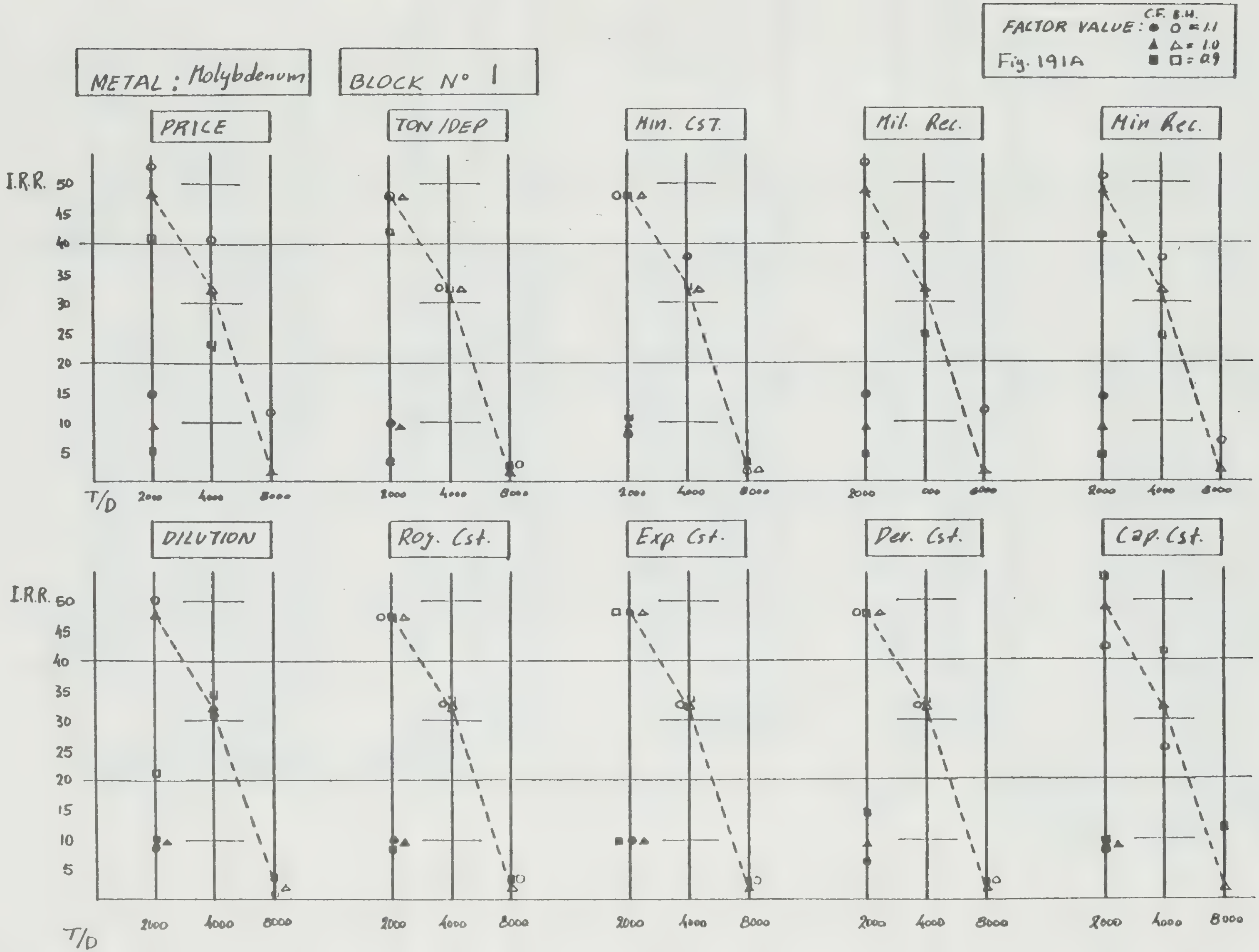

METAL : Ni Cu
BLOCK N° 3
FACTOR VALUE : C.R. O.R.
● ○ = 1.1
▲ △ = 1.0
■ □ = 0.9
Fig. 188 B
GRADE
ENV COST
TRAN COST
M&L COST
I.R.R.
50
45
40
35
30
25
20
15
10
5
T/D
2000
4000
8000

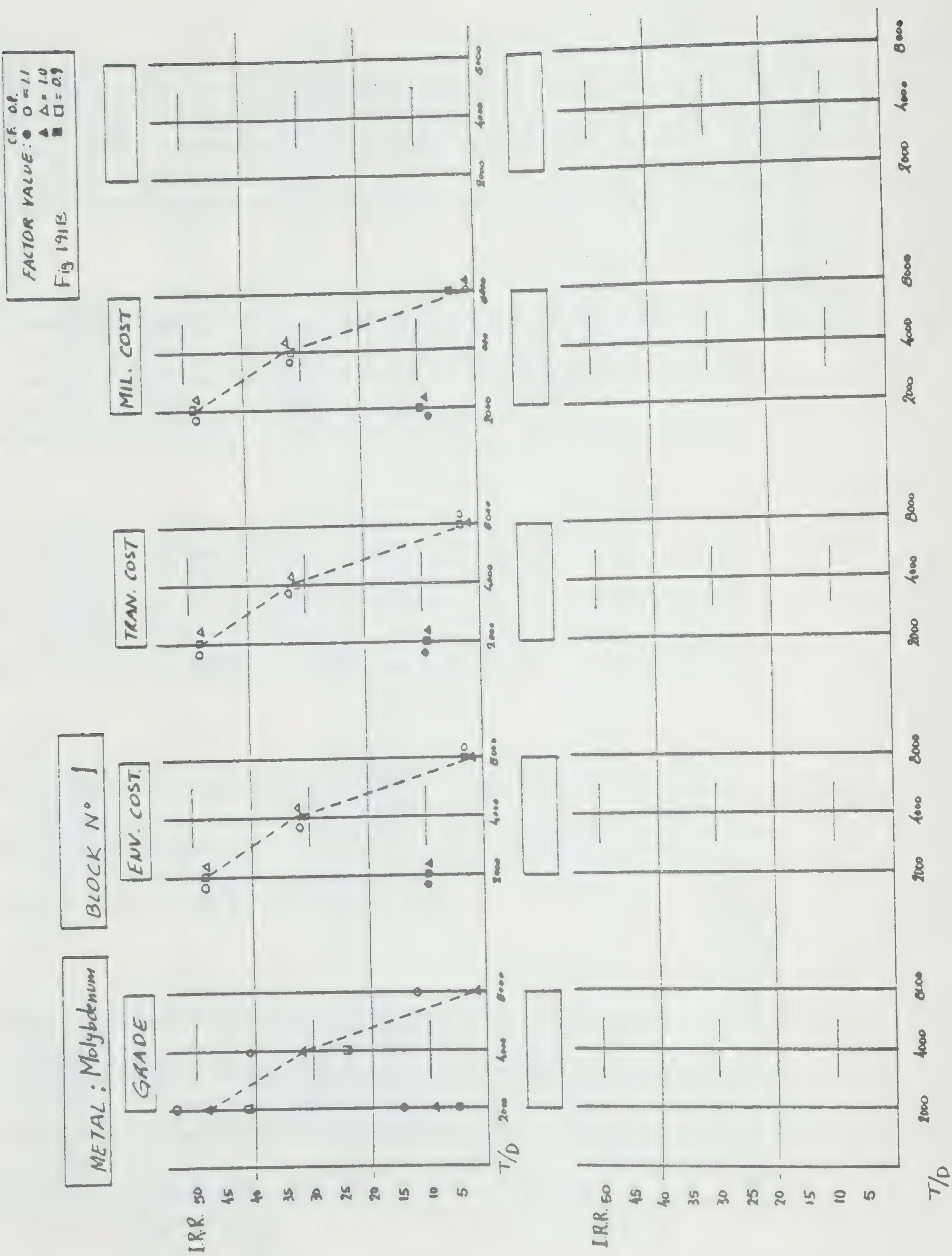

METAL : Ni Cu
BLOCK N° 6
FACTOR VALUE: C.R. O.P. ● ○ = 1.1 ▲ △ = 1.0 ■ □ = 0.9
Fig. 189 A
PRICE
TON/DEP
Min. CST.
Mil. Rec.
Min Rec.
DILUTION
Roy. Cst.
Exp. Cst.
Der. Cst.
Cap. Cst.
I.R.R.
50
45
40
35
30
25
20
15
10
5
T/D
2000
4000
8000

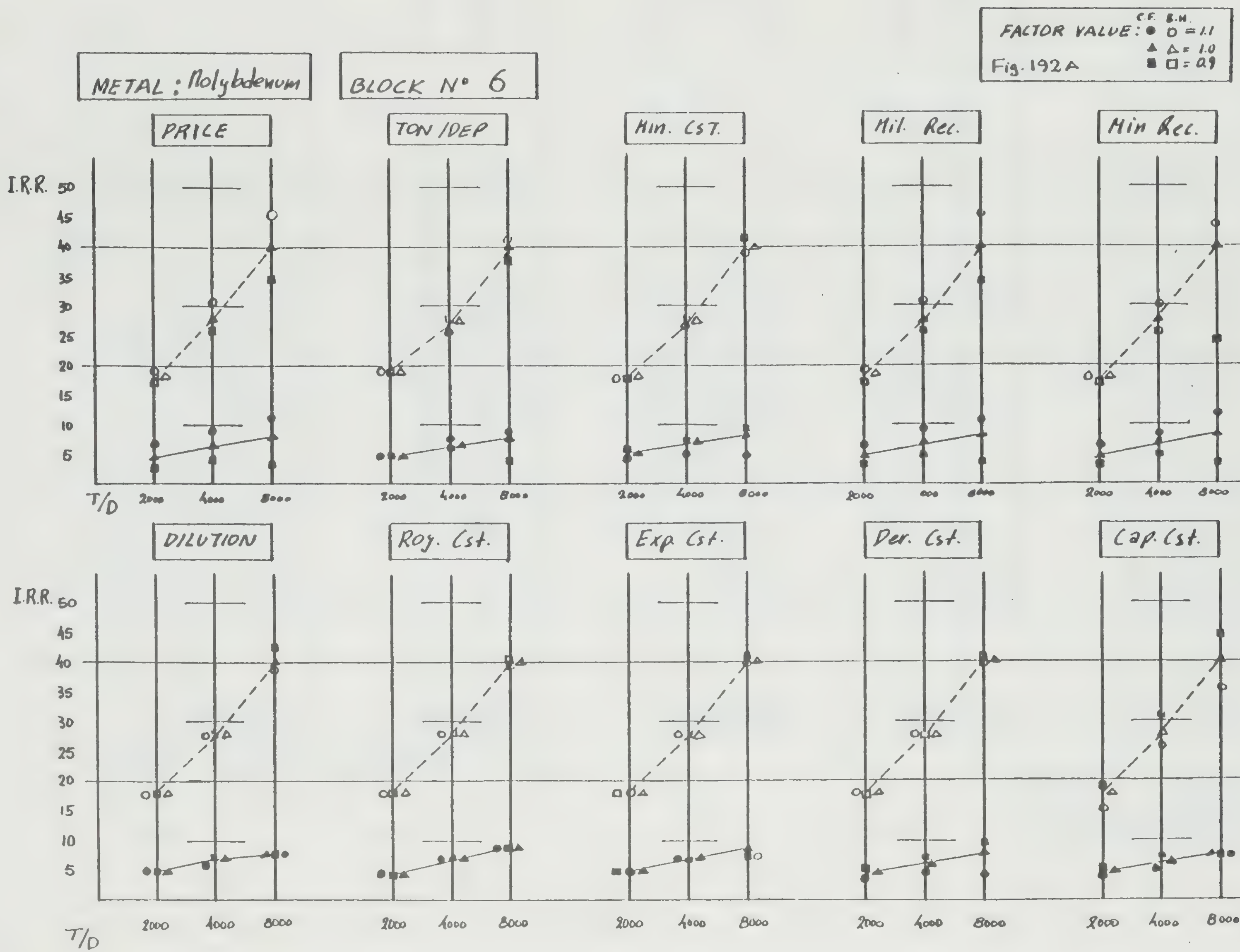

METAL : Ni Cu
BLOCK N° 6
FACTOR VALUE : C.F. O.P.
● ○ = 1.1
▲ △ = 1.0
■ □ = 0.9
Fig 189 B
GRADE
ENV COST
TRAN COST
MIL COST
I.R.R.
50
45
40
35
30
25
20
15
10
5
T/D
2000
4000
8000

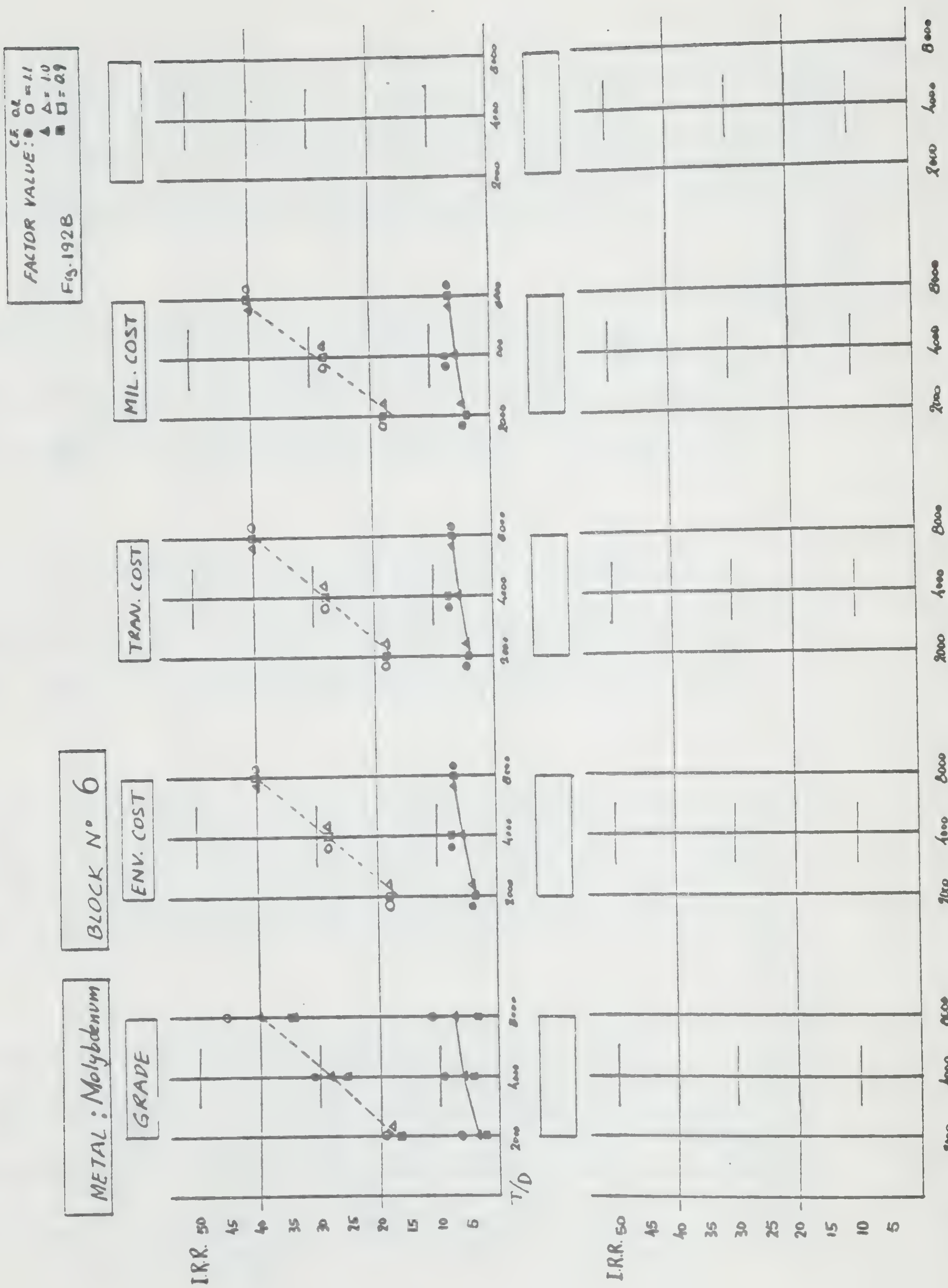

METAL : Ni Cu
BLOCK N° 7
FACTOR VALUE : ○ = 1.1 △ = 1.0 □ = 0.9
Fig. 190A
PRICE
TON /DEP
Min. CST.
Mil. Rec.
Min Rec.
DILUTION
Roy. Cst.
Exp Cst.
Dev. Cst.
Cap. Cst.
I.R.R.
T/D
2000
4000
8000

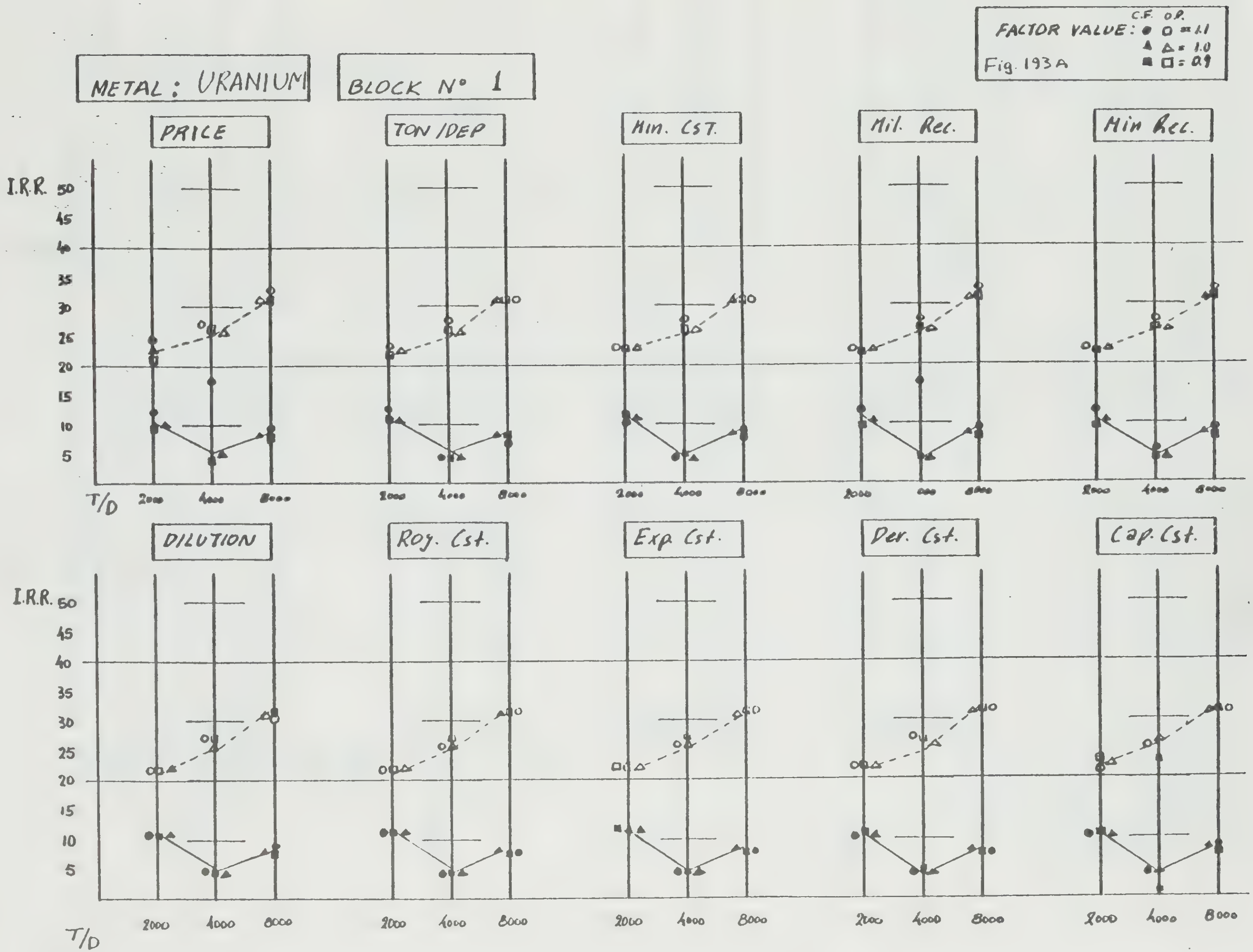

METAL : Ni Cu.
BLOCK N° 7
FACTOR VALUE: C.F. ● ▲ ■ O.R. ○ = 1.1 △ = 1.0 □ = 0.9
Fig 190B
GRADE
ENV. COST
TRAN COST
MIL COST
I.R.R.
50
45
40
35
30
25
20
15
10
5
T/D
2000
4000
8000

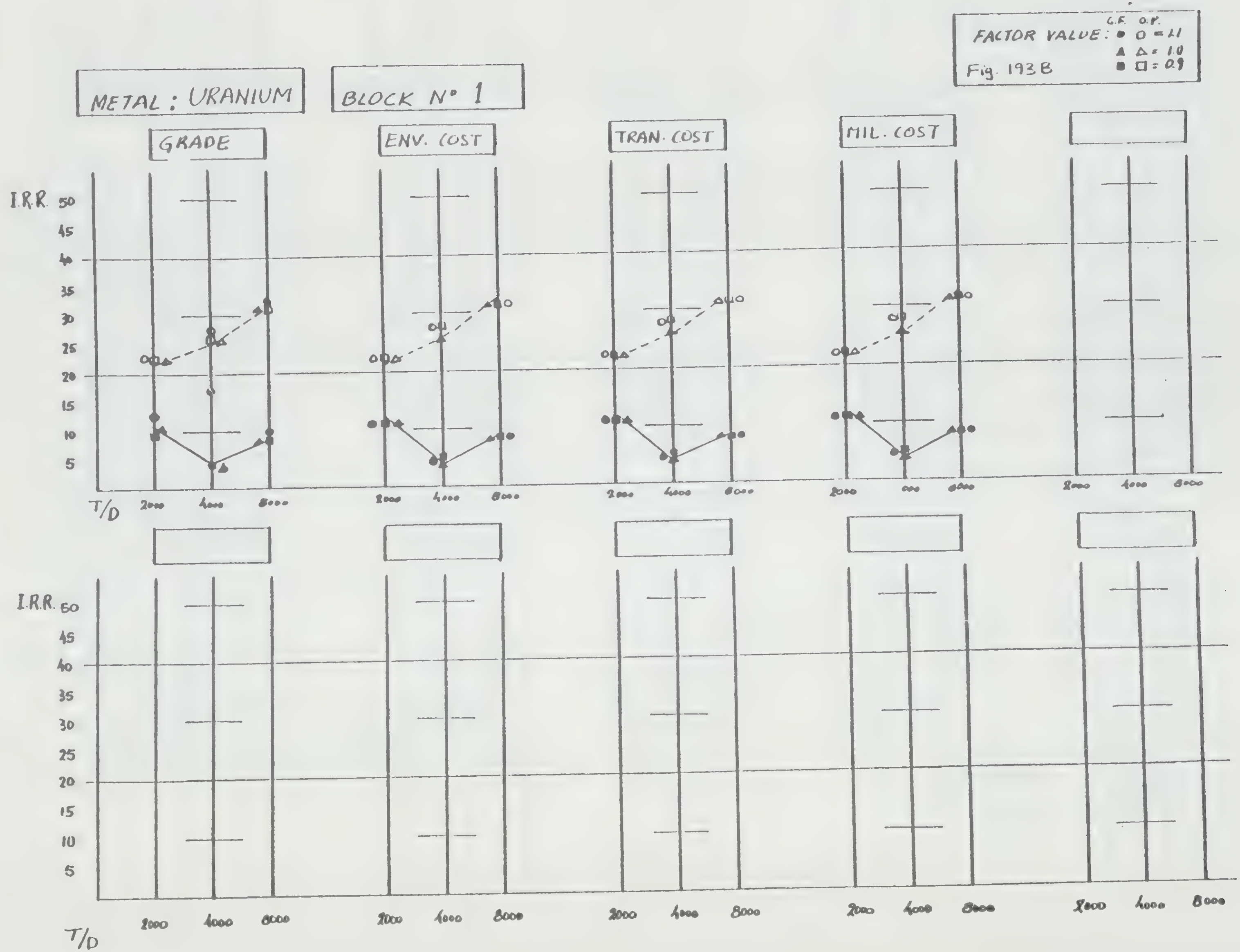

METAL : Molybdenum
BLOCK N° 1
FACTOR VALUE : C.F. ● B.H. ○ = 1.1
▲ △ = 1.0
■ □ = 0.9
Fig. 191A
PRICE
TON /DEP
Min. CST.
Mil. Rec.
Min Rec.
DILUTION
Roy. Cst.
Exp Cst.
Dev. Cst.
Cap. Cst.
I.R.R.
50
45
40
35
30
25
20
15
10
5
T/D
2000
4000
8000

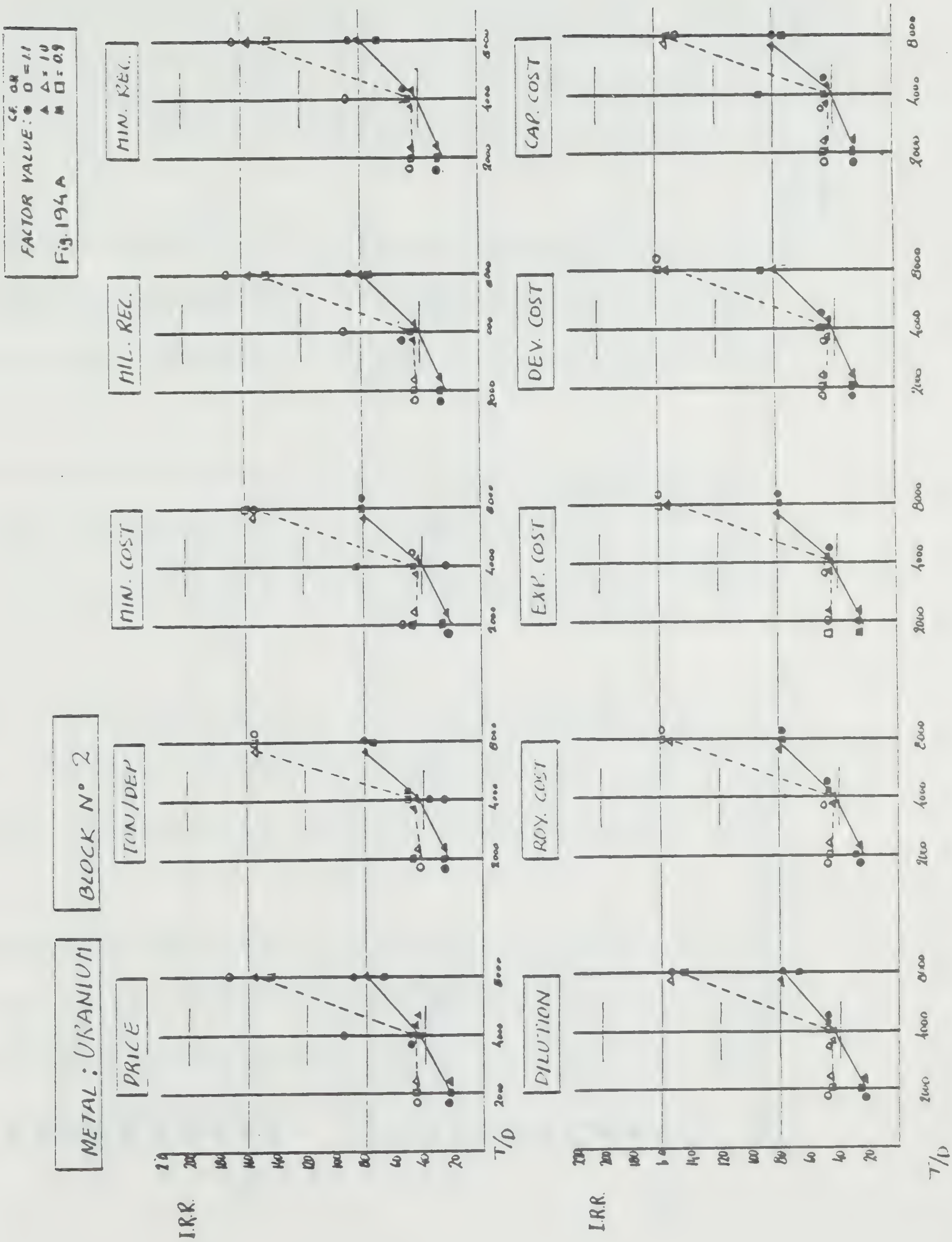

FACTOR VALUE : C.F. O.P.
Fig 191B
METAL : Molybdenum
BLOCK N° 1
GRADE
ENV. COST.
TRAN. COST
MIL. COST
I.R.R.
T/D


METAL : Molybdenum
BLOCK N° 6
FACTOR VALUE : C.F. ● ▲ ■ B.M. ○ = 1.1 △ = 1.0 □ = 0.9
Fig. 192A
PRICE
TON/DEP
Min. Cst.
Mil. Rec.
Min Rec.
DILUTION
Roy. Cst.
Exp. Cst.
Der. Cst.
Cap. Cst.
I.R.R.
50
45
40
35
30
25
20
15
10
5
T/D
2000
4000
8000

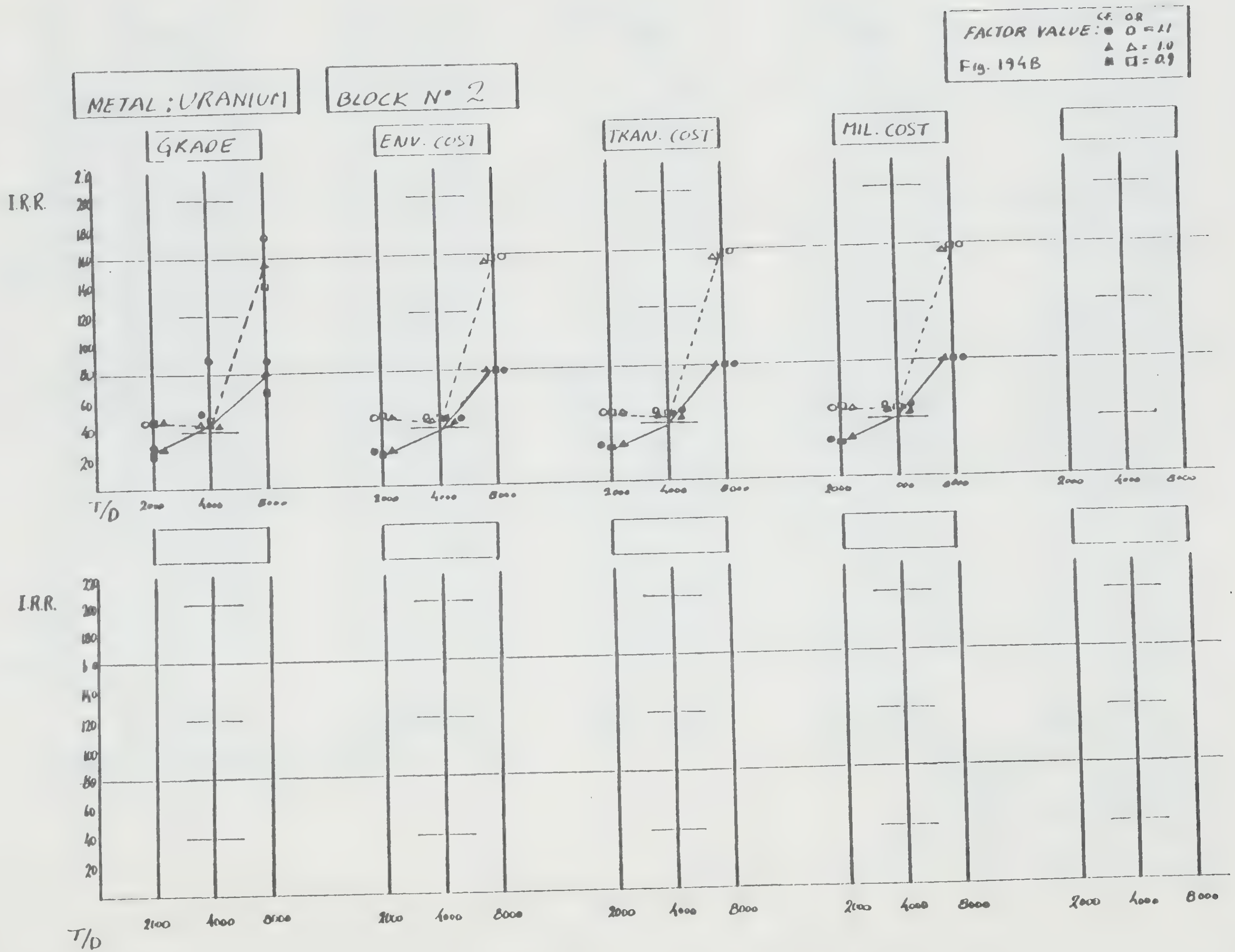

METAL : Molybdenum
BLOCK N° 6
FACTOR VALUE : C.F. O.R.
Fig.192B
GRADE
ENV. COST
TRAN. COST
MIL. COST
I.R.R.
T/D

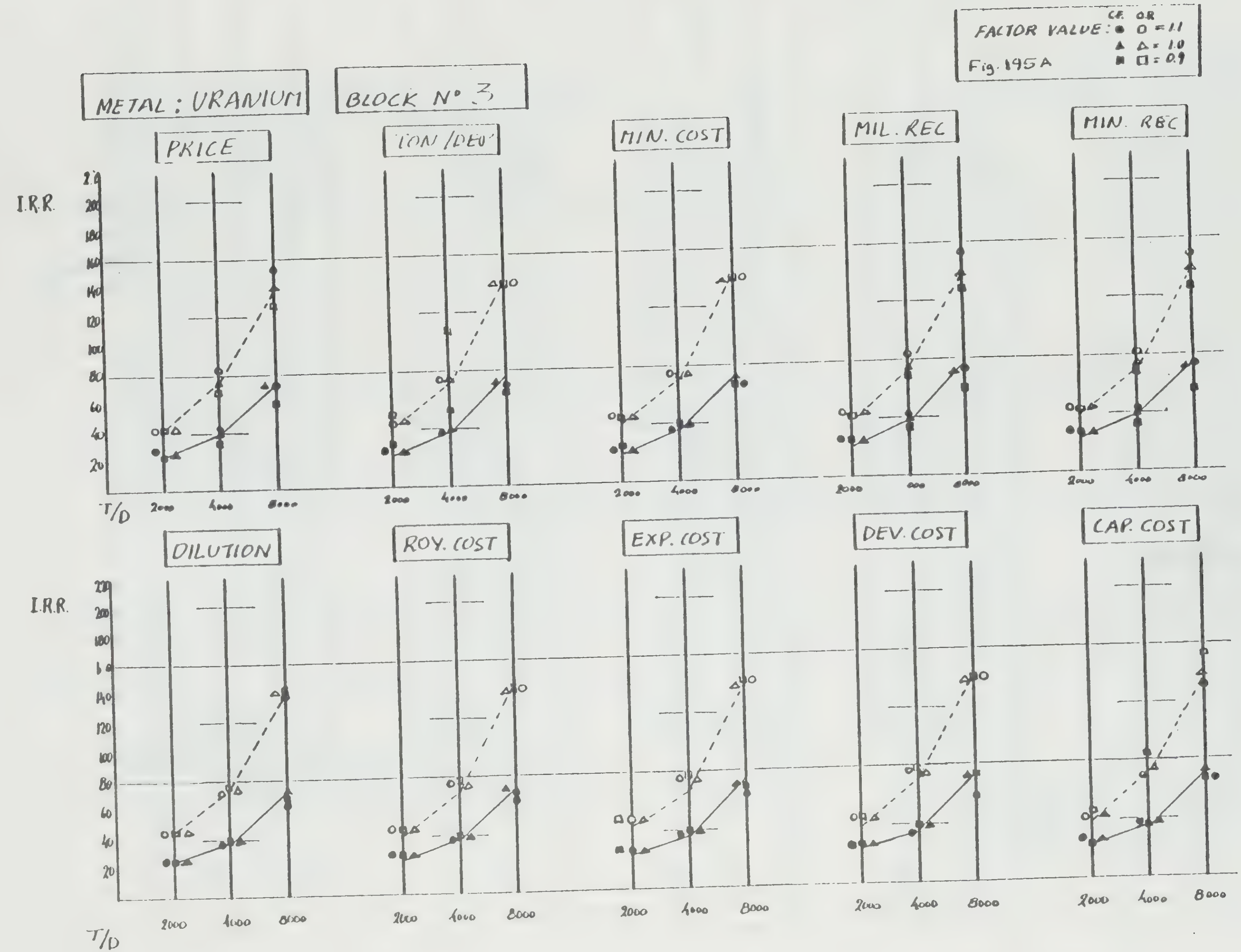

METAL: URANIUM
BLOCK N° 1
FACTOR VALUE: C.F. ● O.P. ○ = 1.1
▲ △ = 1.0
■ □ = 0.9
Fig. 193A
PRICE
TON/DEP
Min. CST.
Mil. Rec.
Min Rec.
DILUTION
Roy. Cst.
Exp Cst.
Der. Cst.
Cap. Cst.
I.R.R.
50
45
40
35
30
25
20
15
10
5
T/D
2000
4000
8000

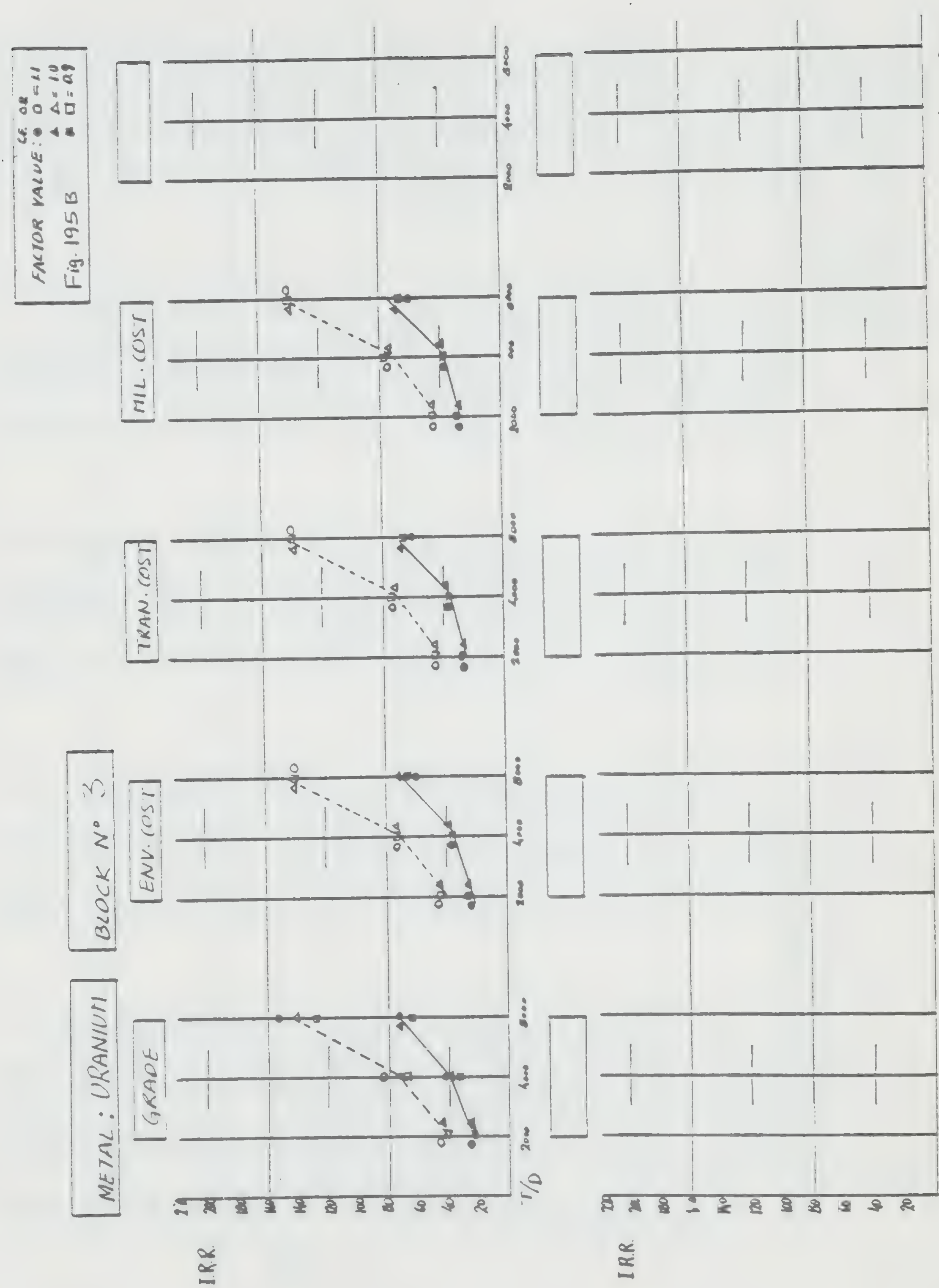

METAL : URANIUM
BLOCK N° 1
FACTOR VALUE : C.F. O.P.
● ○ = 1.1
▲ △ = 1.0
■ □ = 0.9
Fig. 193B
GRADE
ENV. COST
TRAN. COST
MIL. COST
I.R.R.
50
45
40
35
30
25
20
15
10
5
T/D
2000
4000
8000



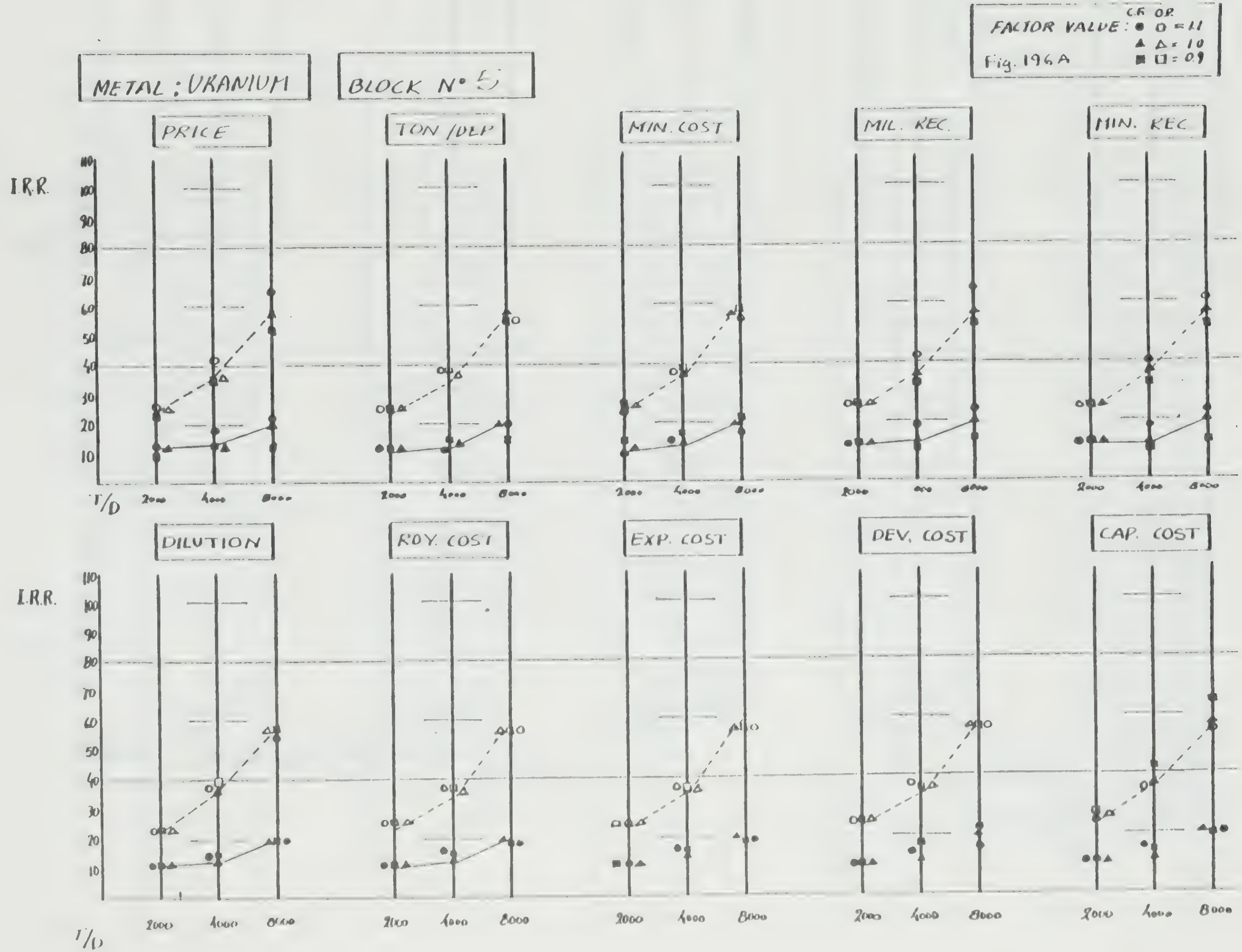
METAL : URANIUM
BLOCK N° 2
FACTOR VALUE
Fig. 194 A
PRICE
TON/DEP
MIN. COST
MIL. REC.
MIN. REC.
DILUTION
ROY. COST
EXP. COST
DEV. COST
CAP. COST
I.R.R.
T/D

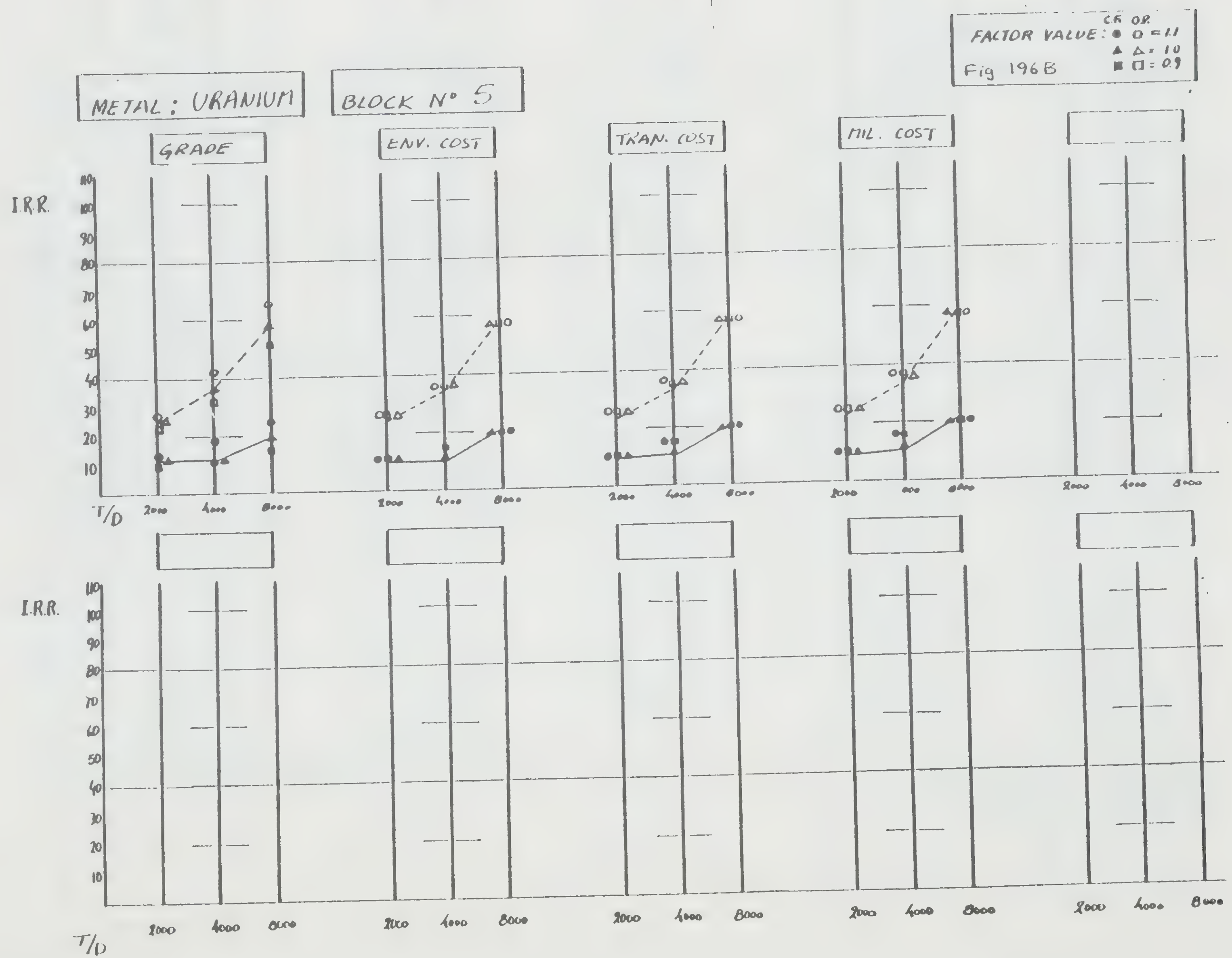

METAL : URANIUM
BLOCK N° 2
FACTOR VALUE: ● O = 1.1
▲ △ = 1.0
■ □ = 0.9
C.F. O.R.
GRADE
ENV. COST
TRAN. COST
MIL. COST
I.R.R.
T/D
2000
4000
8000
Fig. 194B

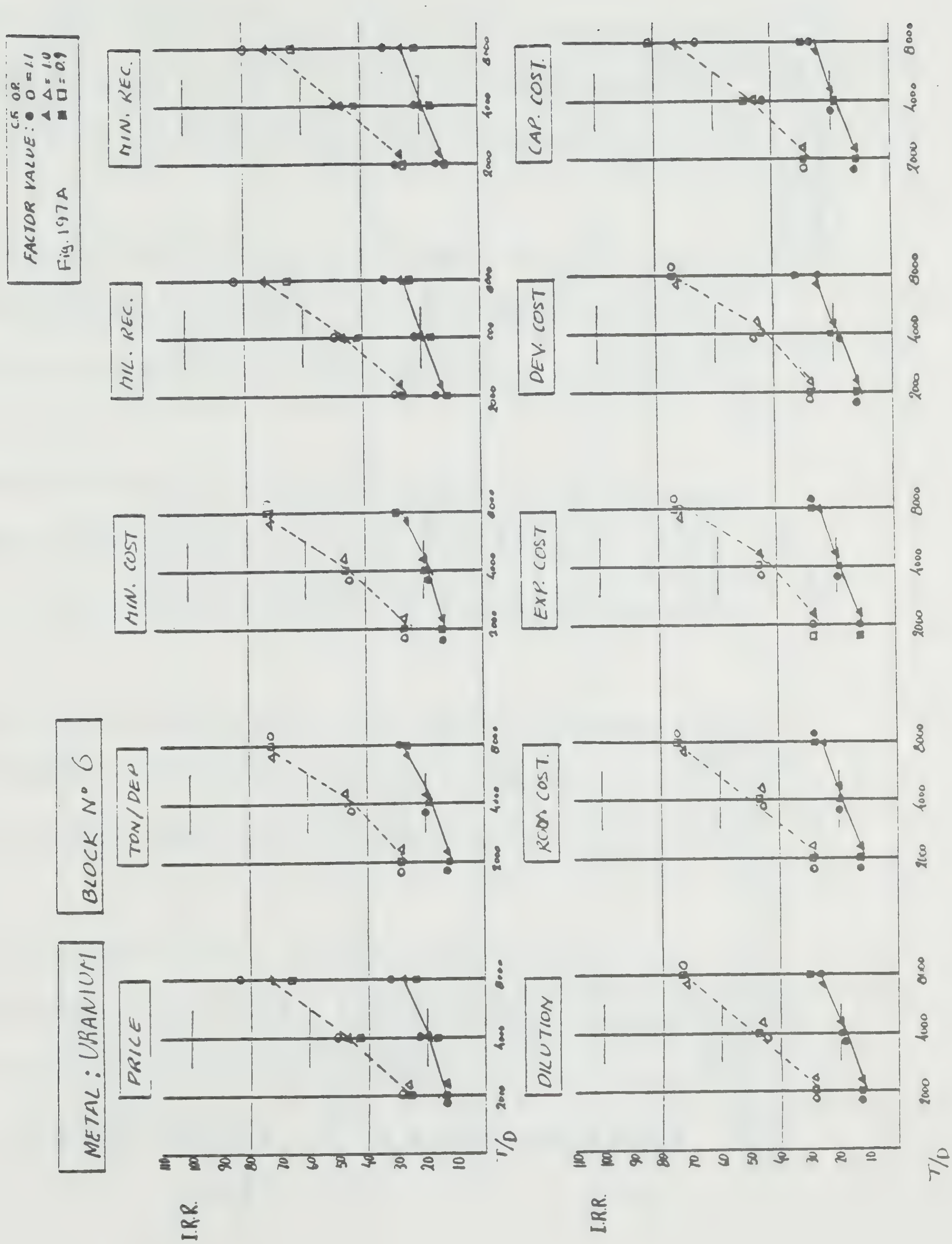

METAL : URANIUM
BLOCK N° 3
FACTOR VALUE: CF. OR ● O = 1.1 ▲ Δ = 1.0 ■ □ = 0.9
Fig. 195A
PRICE
TON /DEV
MIN. COST
MIL. REC
MIN. REC
DILUTION
ROY. COST
EXP. COST
DEV. COST
CAP. COST
I.R.R.
T/D
2000
4000
8000
20
40
60
80
100
120
140
160
180
200

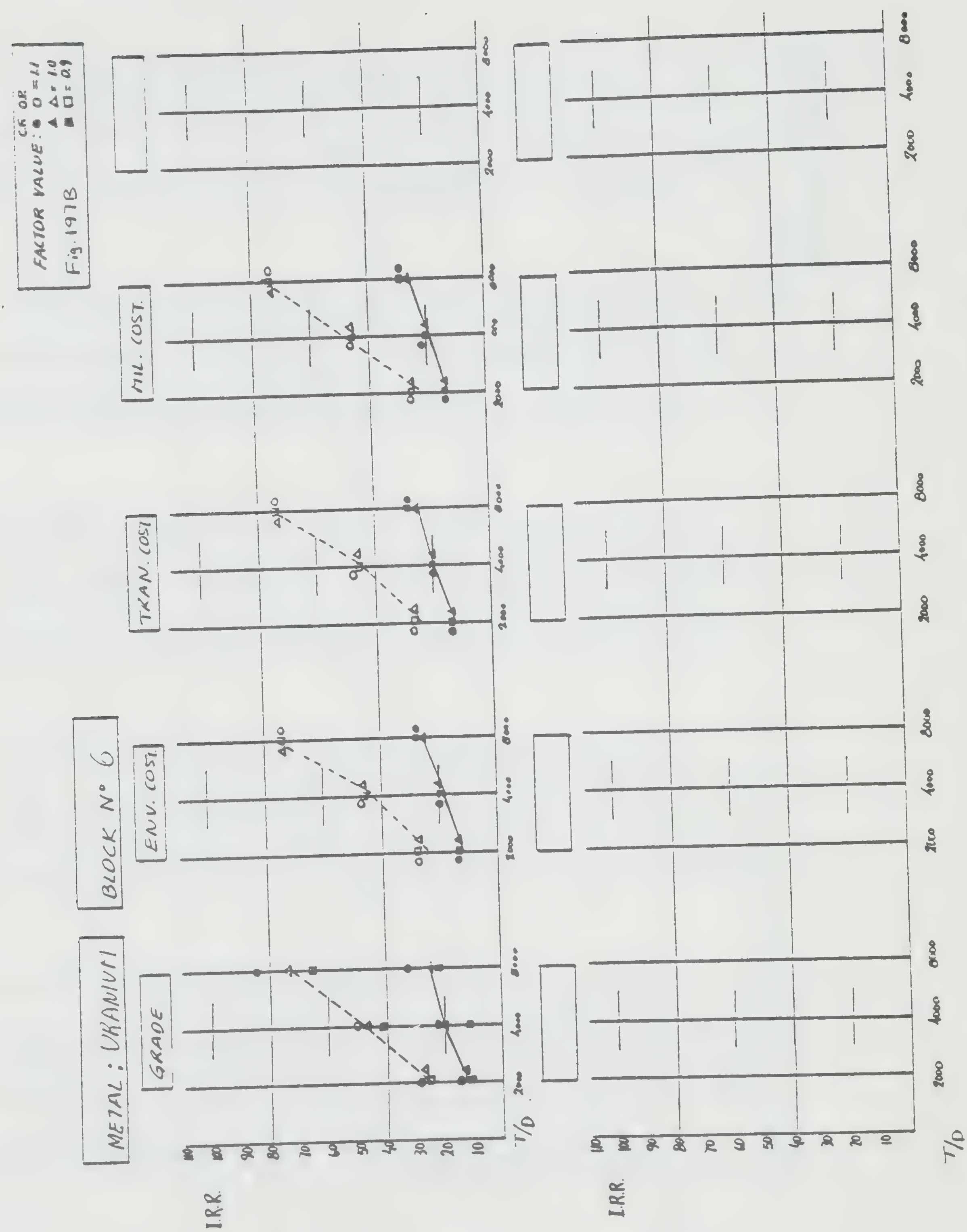


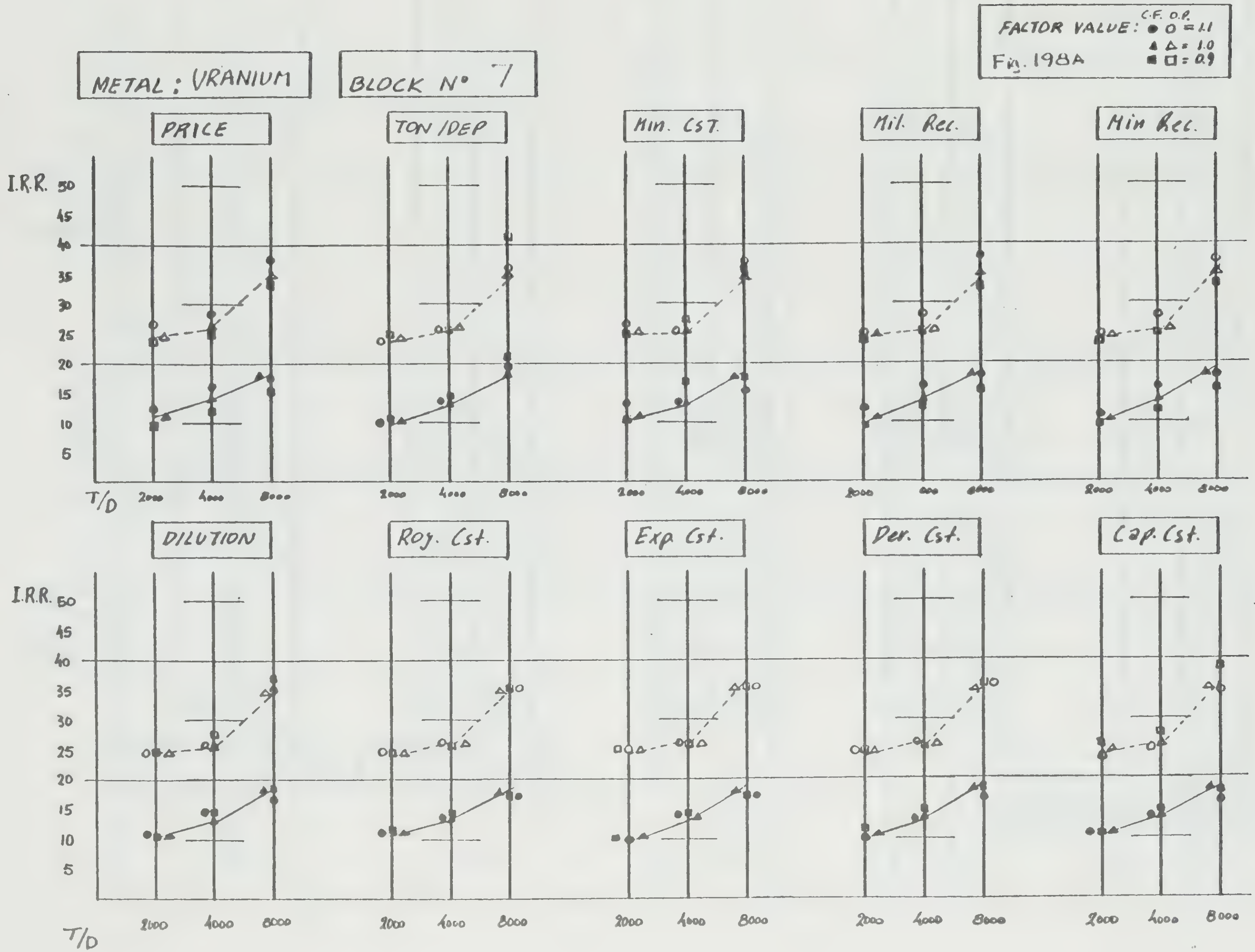
METAL : URANIUM
BLOCK N° 3
FACTOR VALUE: ● ○ = 1.1 ▲ △ = 1.0 ■ □ = 0.9
Fig. 195 B
GRADE
ENV. COST
TRAN. COST
MIL. COST
I.R.R.
T/D

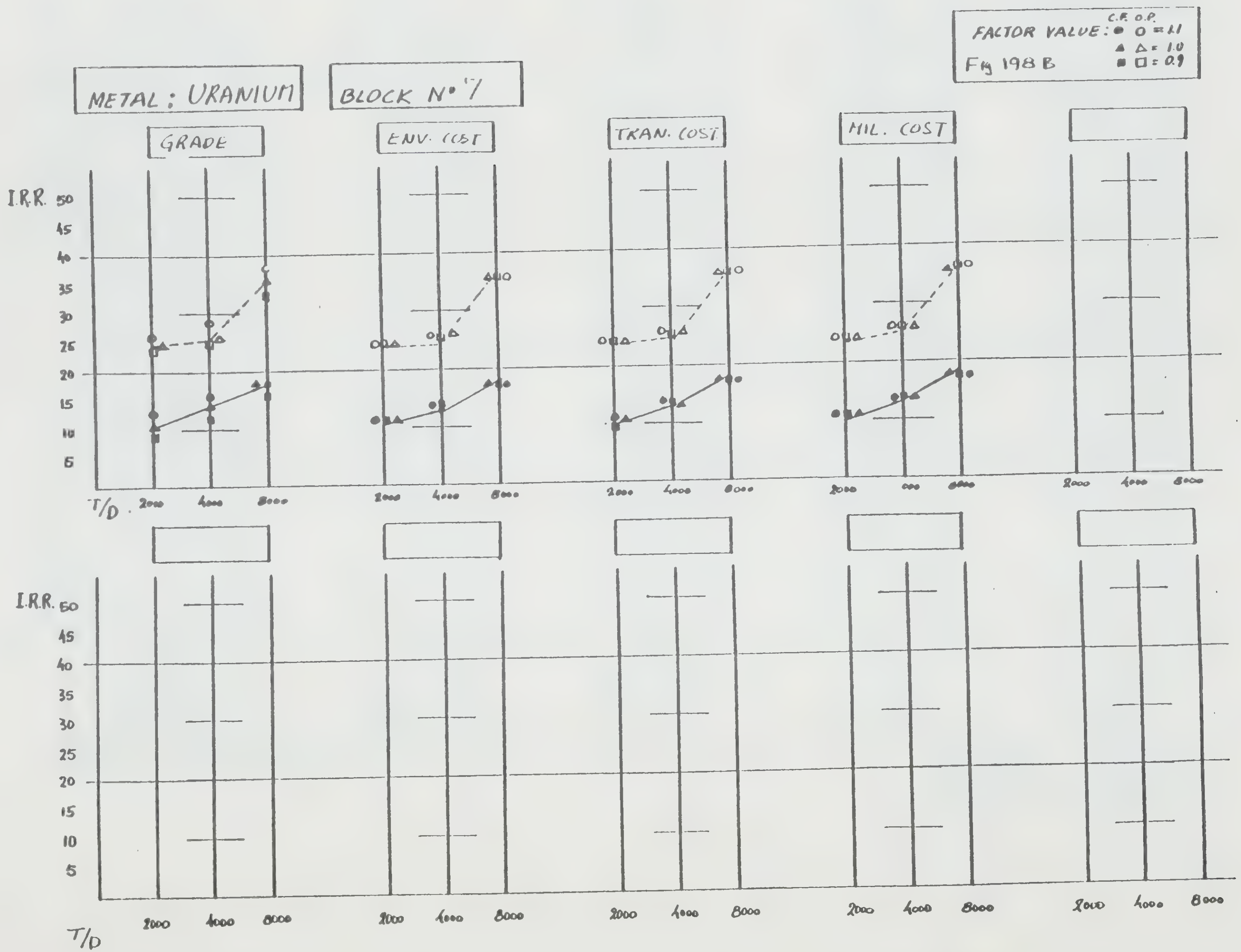

FACTOR VALUE: C.F. OR. ● ○ = 1.1 ▲ △ = 1.0 ■ □ = 0.9
Fig. 196A
METAL : URANIUM
BLOCK N° 5
PRICE
TON/DEP
MIN. COST
MIL. REC.
MIN. REC
DILUTION
ROY. COST
EXP. COST
DEV. COST
CAP. COST
I.R.R.
T/D
2000
4000
8000
10
20
30
40
50
60
70
80
90
100
110


METAL : URANIUM
BLOCK N° 5
FACTOR VALUE: CR. ● ▲ ■ OR. ○ △ □ ; = 1.1 ; = 1.0 ; = 0.9
Fig 196B
GRADE
ENV. COST
TRAN. COST
MIL. COST
I.R.R.
T/D
2000
4000
8000


METAL : URANIUM
BLOCK N° 6
FACTOR VALUE
Fig. 197A
PRICE
TON/DEP
MIN. COST
MIL. REC.
MIN. REC.
DILUTION
EXP. COST
DEV. COST
CAP. COST
I.R.R.
T/D


METAL : URANIUM
BLOCK N° 6
Fig. 197B
FACTOR VALUE
GRADE
ENV. COST
TRAN. COST
MIL. COST
I.R.R.
T/D


FACTOR VALUE: C.F. O.P. ● ○ = 1.1 ▲ △ = 1.0 ■ □ = 0.9
Fig. 198A
METAL: URANIUM
BLOCK N° 7
PRICE
TON/DEP
Min. CST.
Mil. Rec.
Min Rec.
DILUTION
Roy. Cst.
Exp Cst.
Der. Cst.
Cap. Cst.
I.R.R.
50
45
40
35
30
25
20
15
10
5
T/D
2000
4000
8000



METAL: URANIUM
BLOCK N° 7
FACTOR VALUE: C.F. ● O.P. ○ = 1.1
▲ △ = 1.0
■ □ = 0.9
Fig 198 B
GRADE
ENV. COST
TRAN. COST
MIL. COST
I.R.R.
50
45
40
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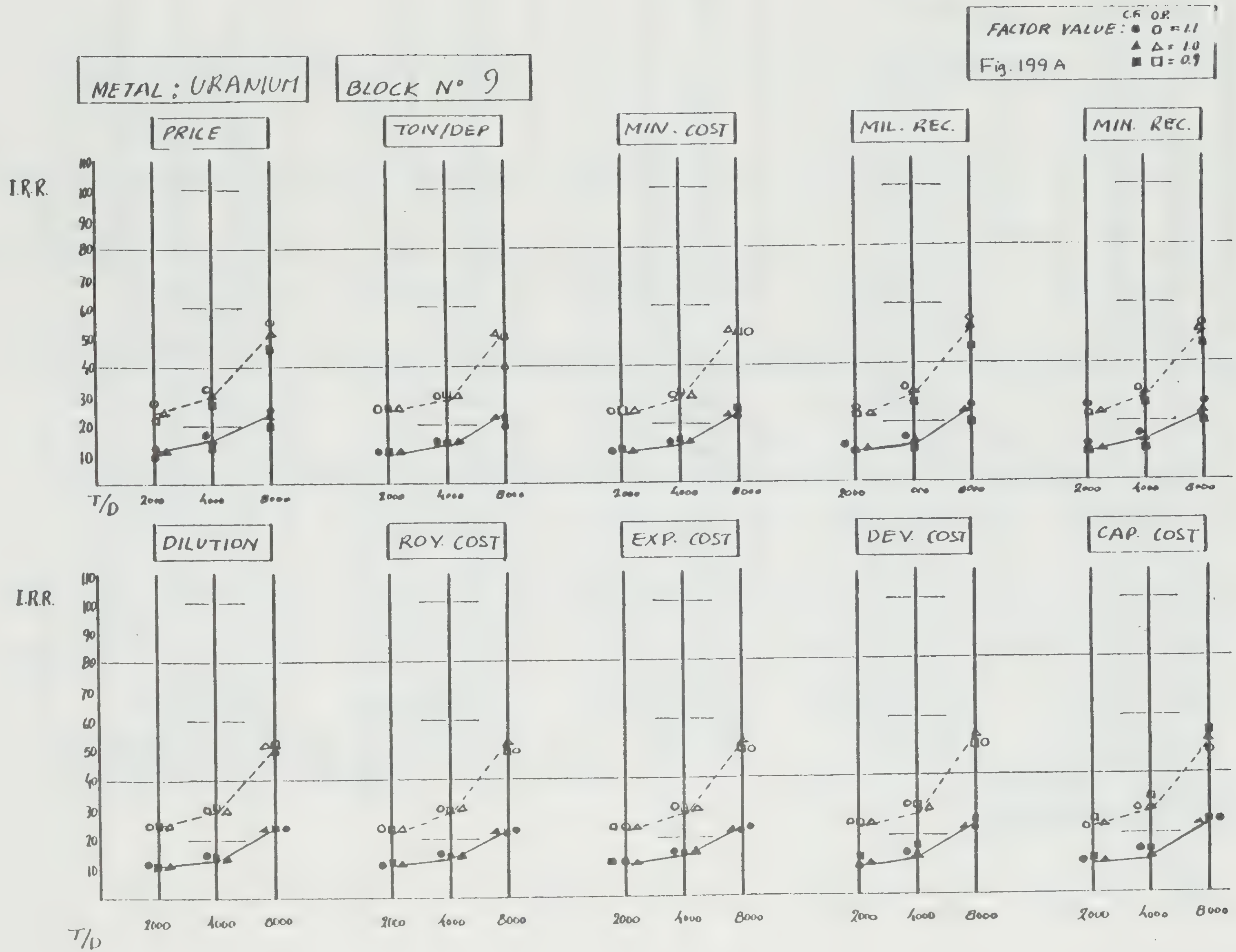
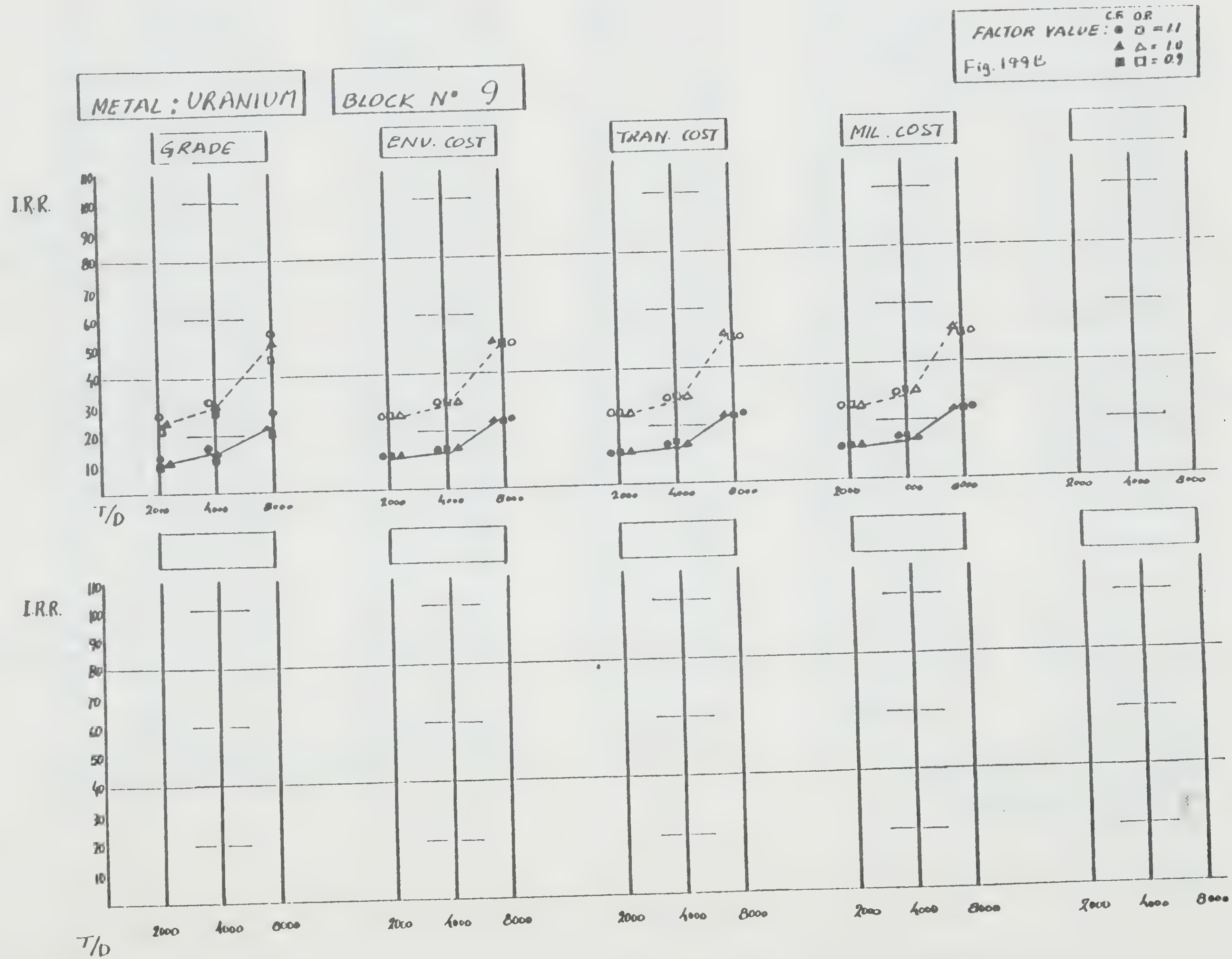
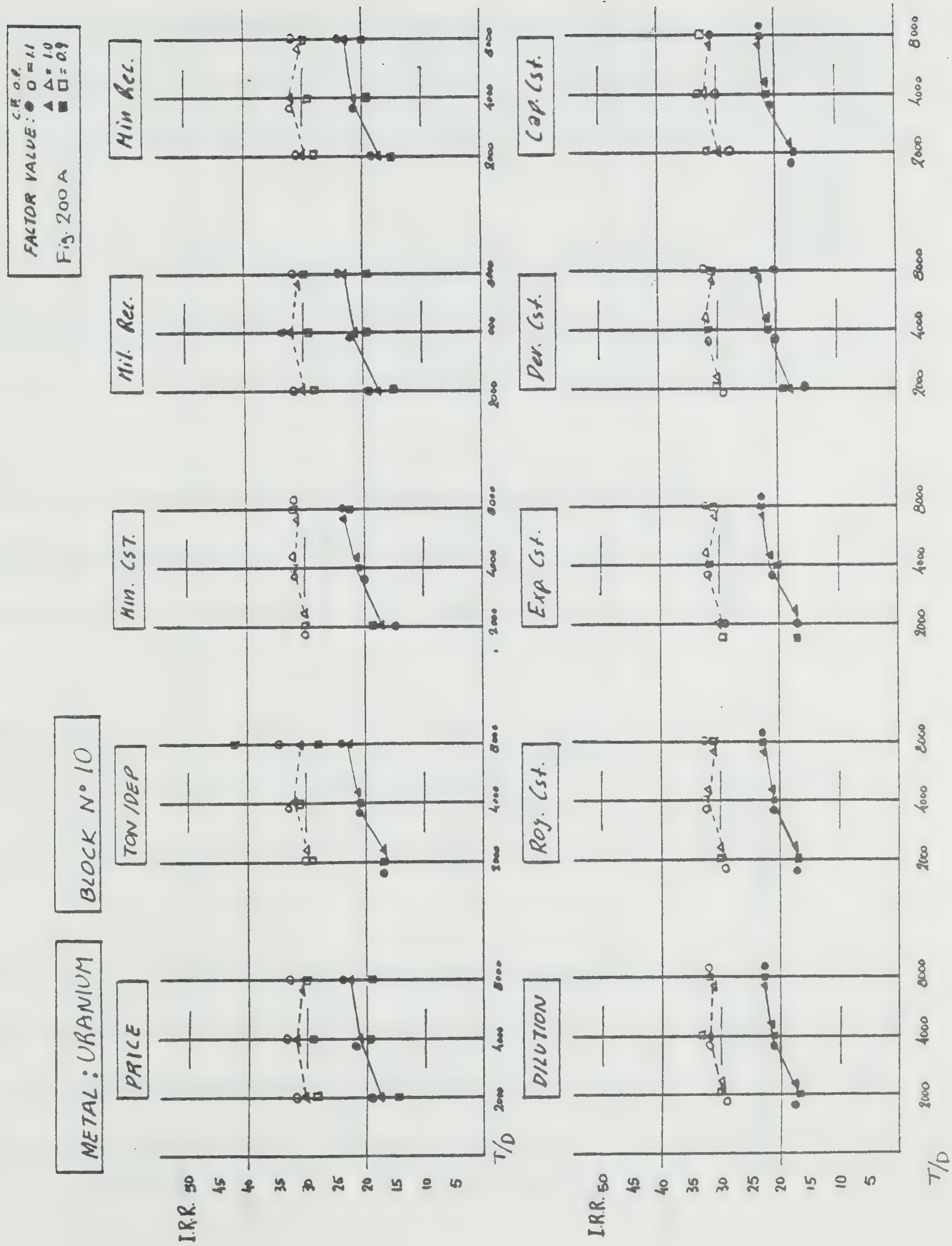
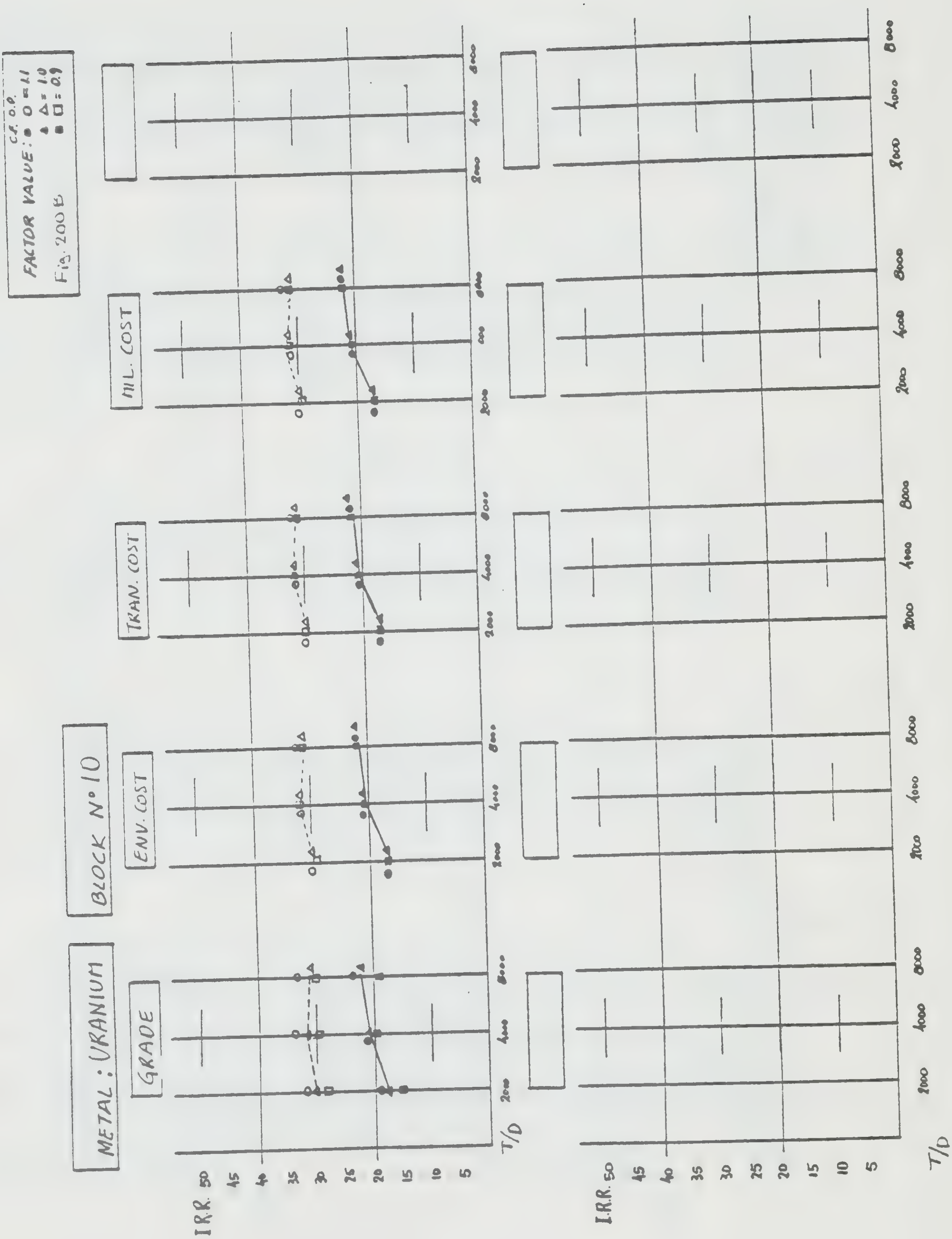
30
25
20
15
10
5
T/D
2000
4000
8000

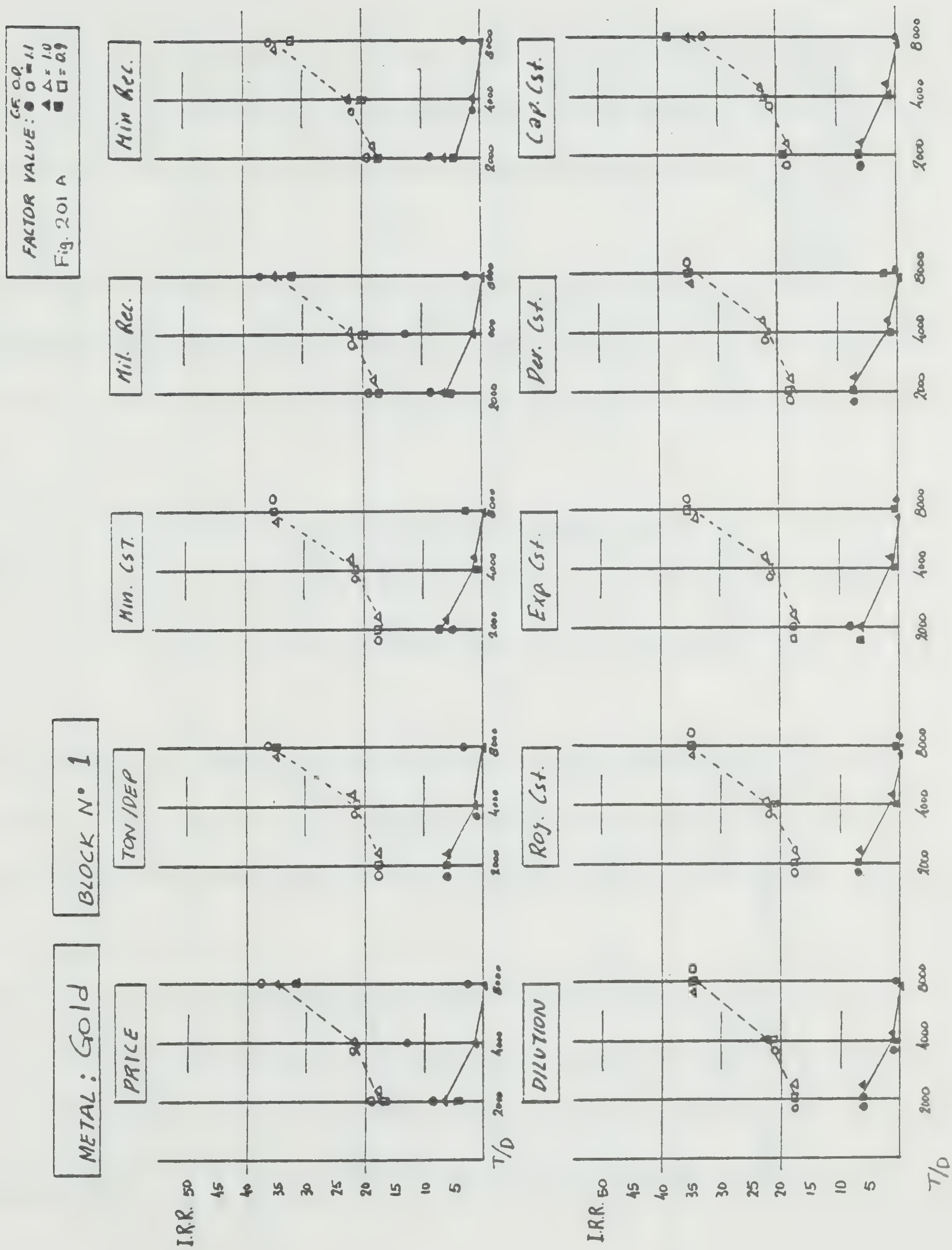


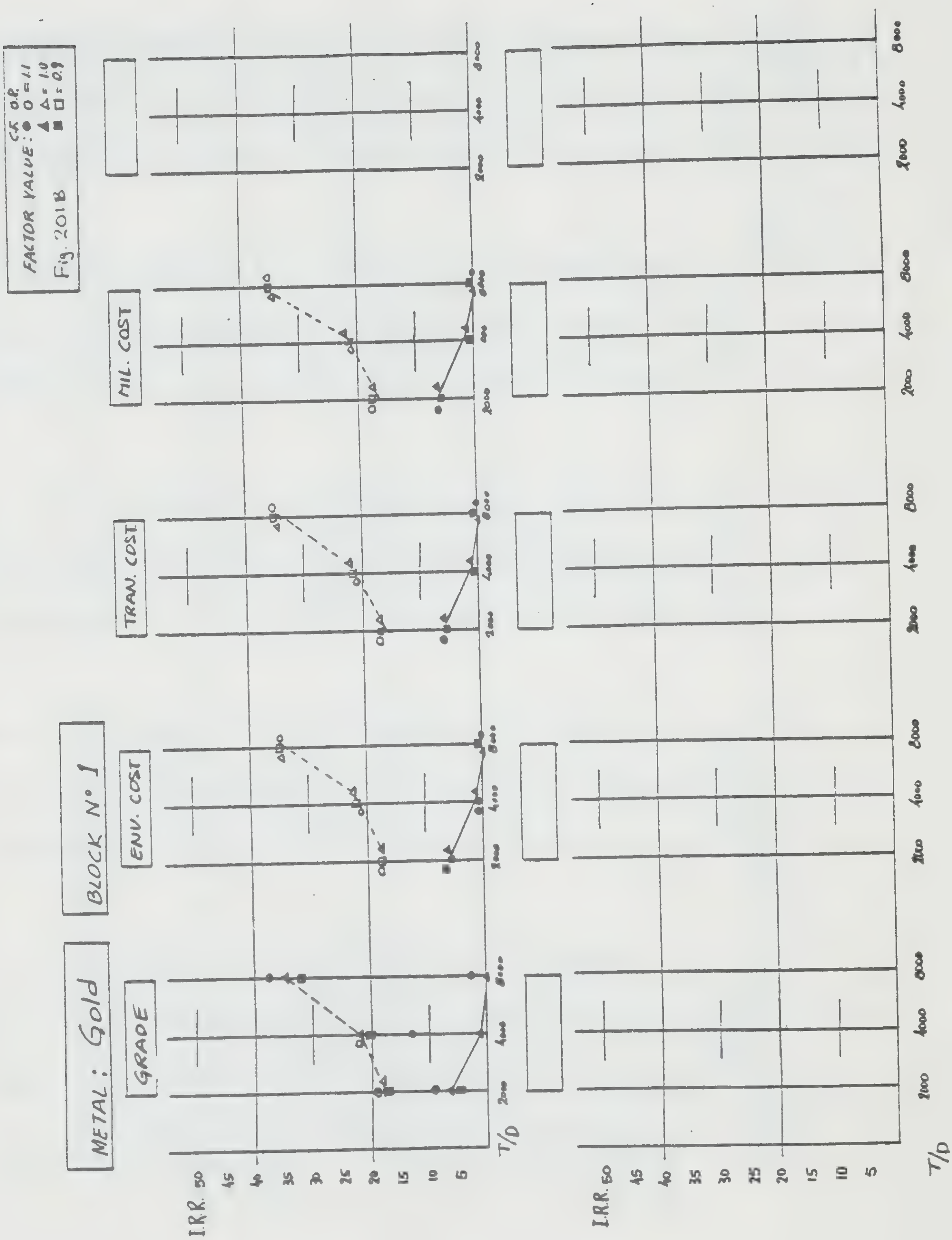
METAL : URANIUM
BLOCK N° 9
FACTOR VALUE : C.F. O.P. ● O = 1.1 ▲ △ = 1.0 ■ □ = 0.9
Fig. 199 A
PRICE
TON/DEP
MIN. COST
MIL. REC.
MIN. REC.
DILUTION
ROY. COST
EXP. COST
DEV. COST
CAP. COST
I.R.R.
T/D


FACTOR VALUE : C.F. OR ● ○ = 1.1 ▲ △ = 1.0 ■ □ = 0.9
Fig. 199E
METAL : URANIUM
BLOCK N° 9
GRADE
ENV. COST
TRAN. COST
MIL. COST
I.R.R.
T/D


METAL : URANIUM
BLOCK N° 10
FACTOR VALUE : C.R. O.R. ● ○ = 1.1 ▲ △ = 1.0 ■ □ = 0.9
Fig. 200 A
PRICE
TON/DEP
MIN. CST.
Mil. Rec.
Min Rec.
DILUTION
Roy. Cst.
Exp Cst.
Dev. Cst.
Cap. Cst.
I.R.R.
50 45 40 35 30 25 20 15 10 5
T/D
2000 4000 8000


METAL: URANIUM
BLOCK N° 10
GRADE
ENV. COST
TRAN. COST
MIL. COST
FACTOR VALUE: C.F. O.P.
● ○ = 1.1
▲ △ = 1.0
■ □ = 0.9
Fig. 200 E
I.R.R.
T/D


METAL: Gold
BLOCK N° 1
FACTOR VALUE: C.F. O.P.
● ○ = 1.1
▲ △ = 1.0
■ □ = 0.9
Fig. 201 A
PRICE
TON/DEP
Min. CST.
Mil. Rec.
Min Rec.
DILUTION
Roy. Cst.
Exp Cst.
Dev. Cst.
Cap. Cst.
I.R.R.
T/D


METAL: Gold
BLOCK N° 1
FACTOR VALUE: C.R. O.R.
● ○ = 1.1
▲ △ = 1.0
■ □ = 0.9
Fig. 201B
GRADE
ENV. COST
TRAN. COST
MIL. COST
I.R.R.
50
45
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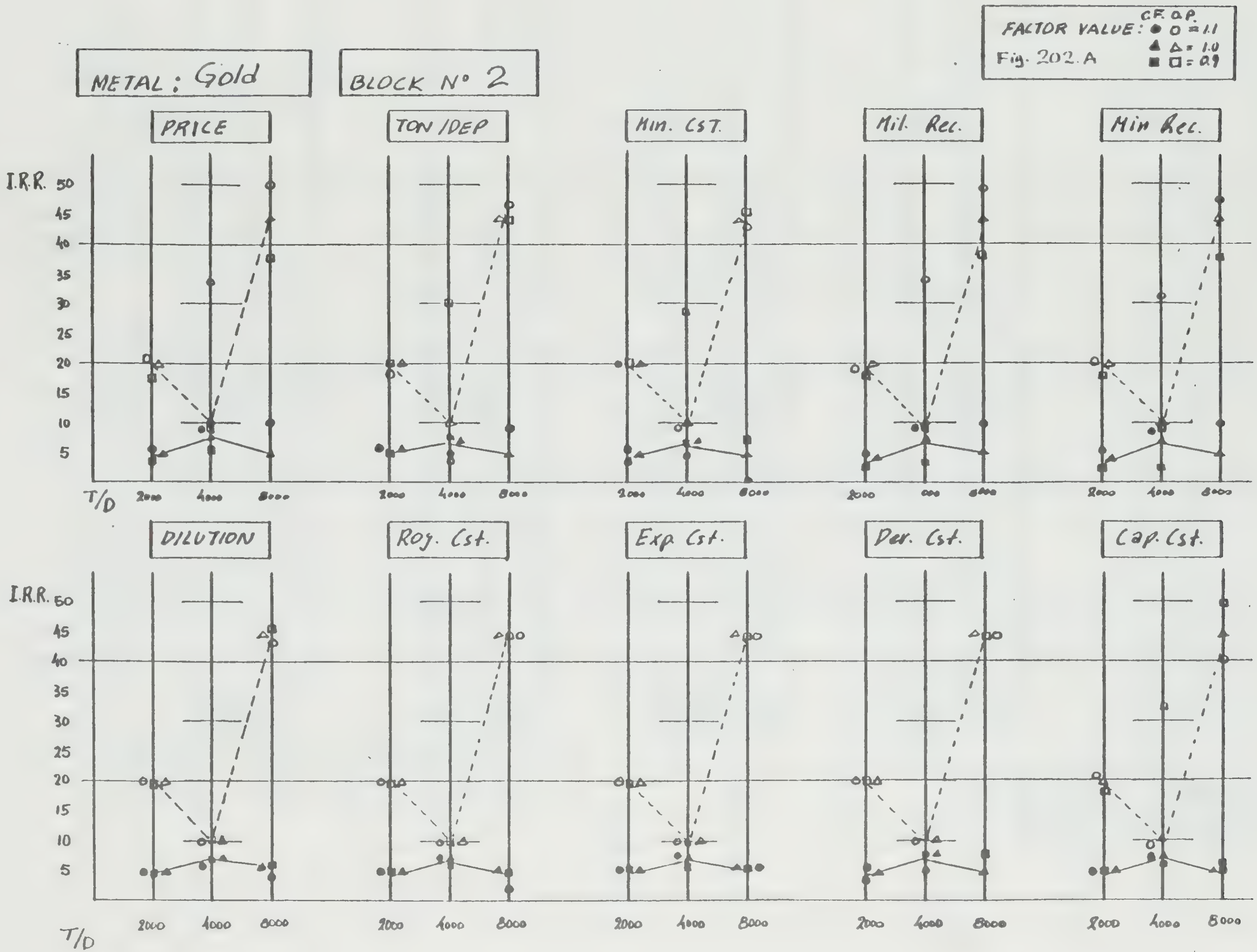
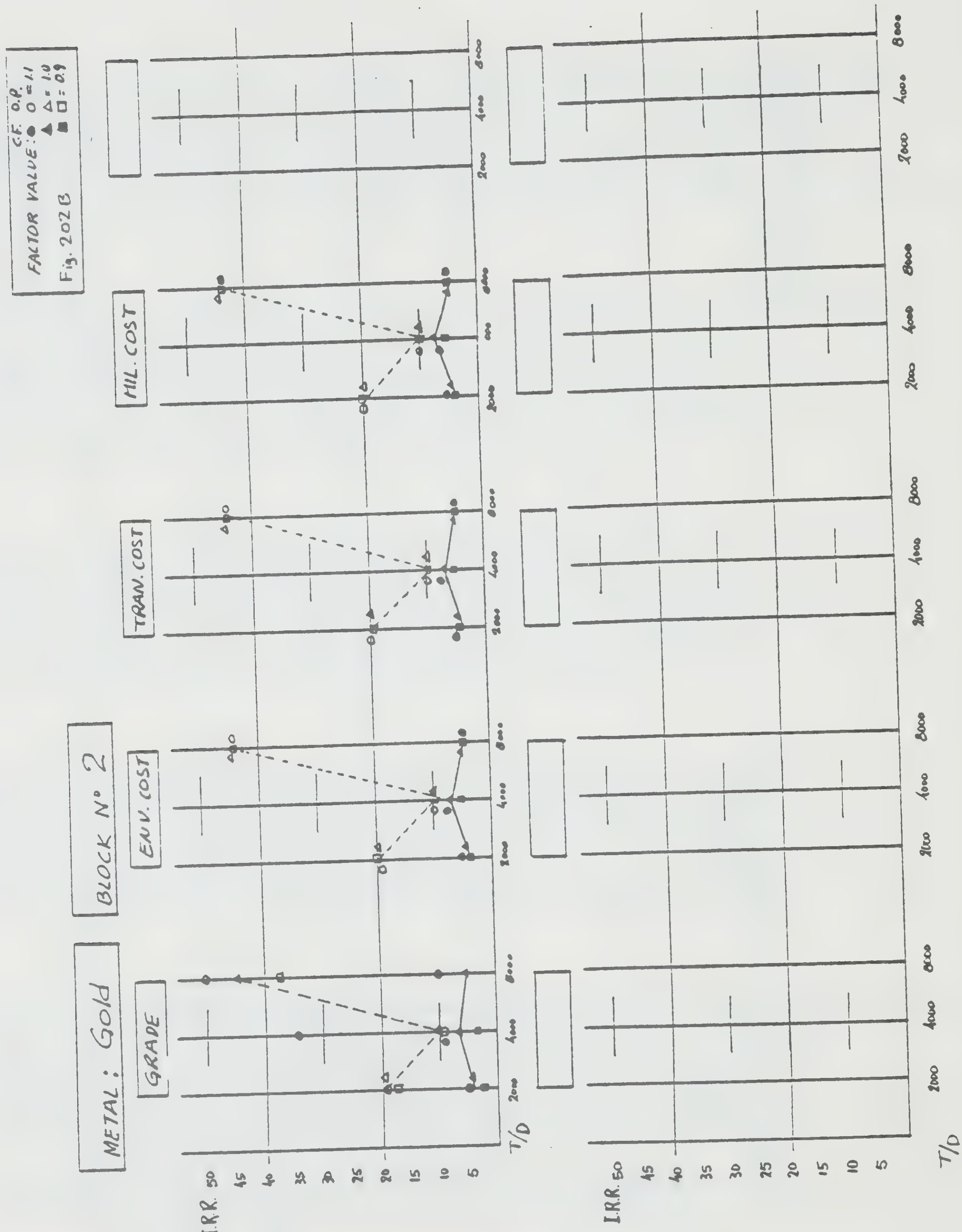
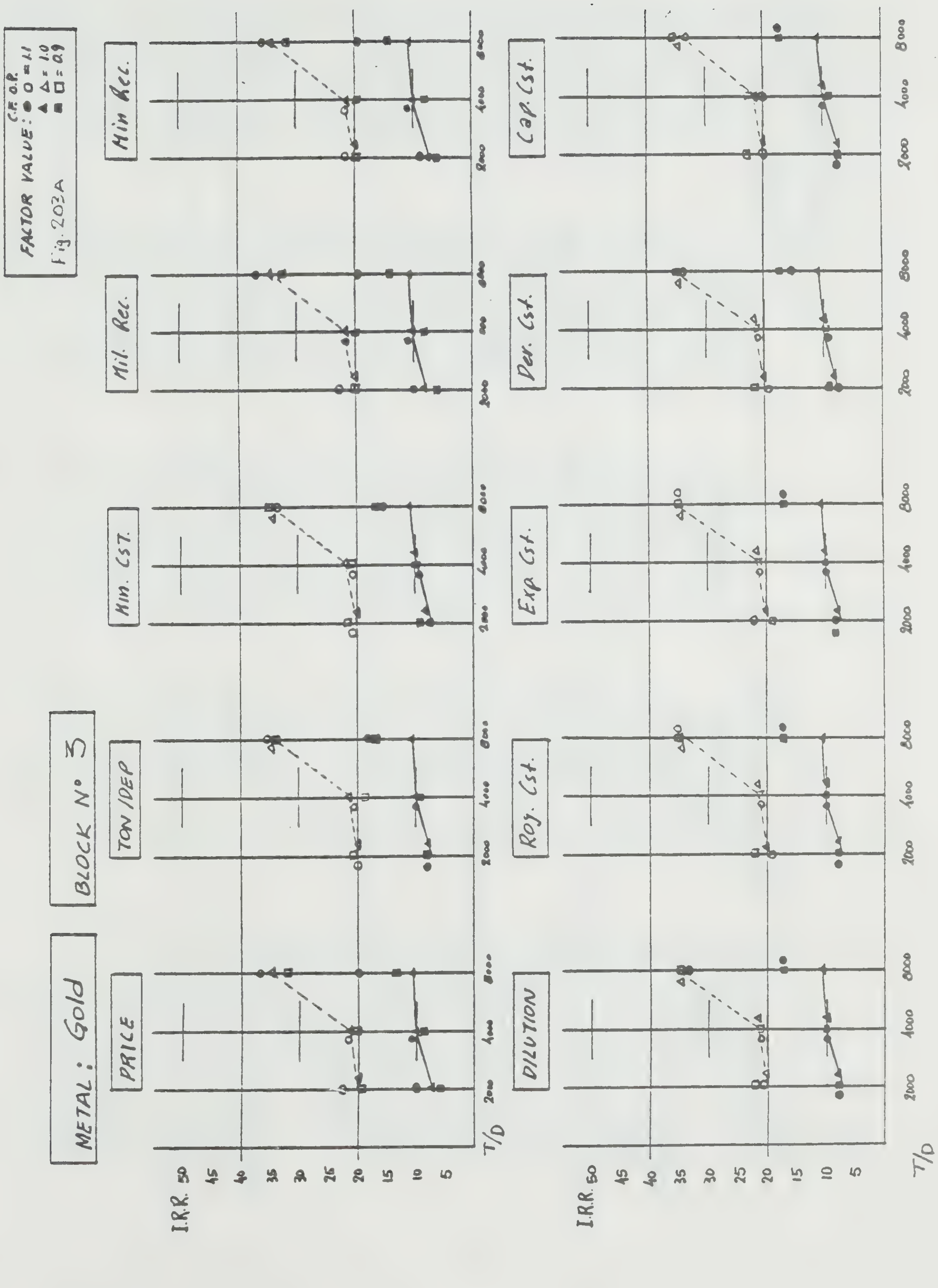
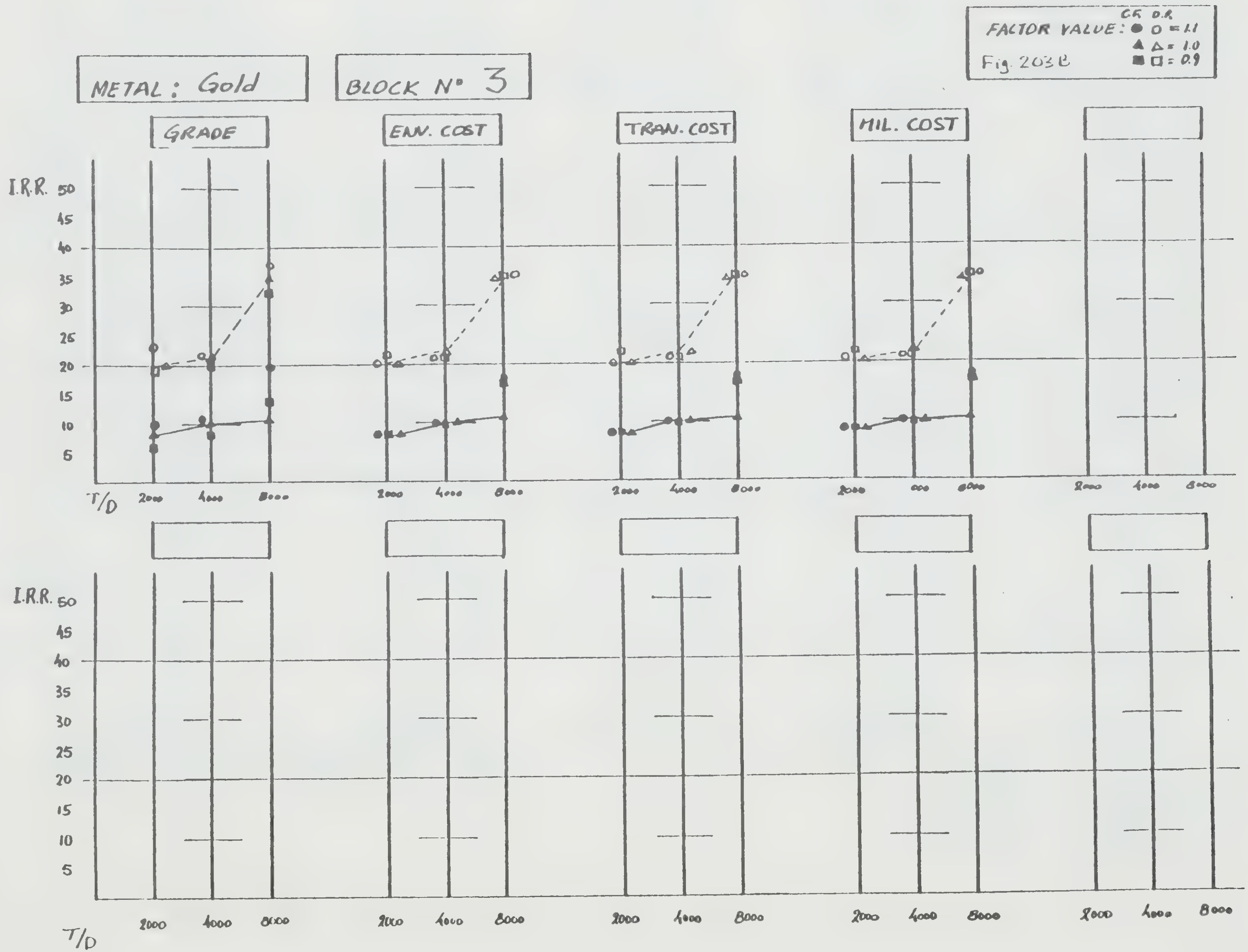
35
30
25
20
15
10
5
T/D
2000
4000
8000

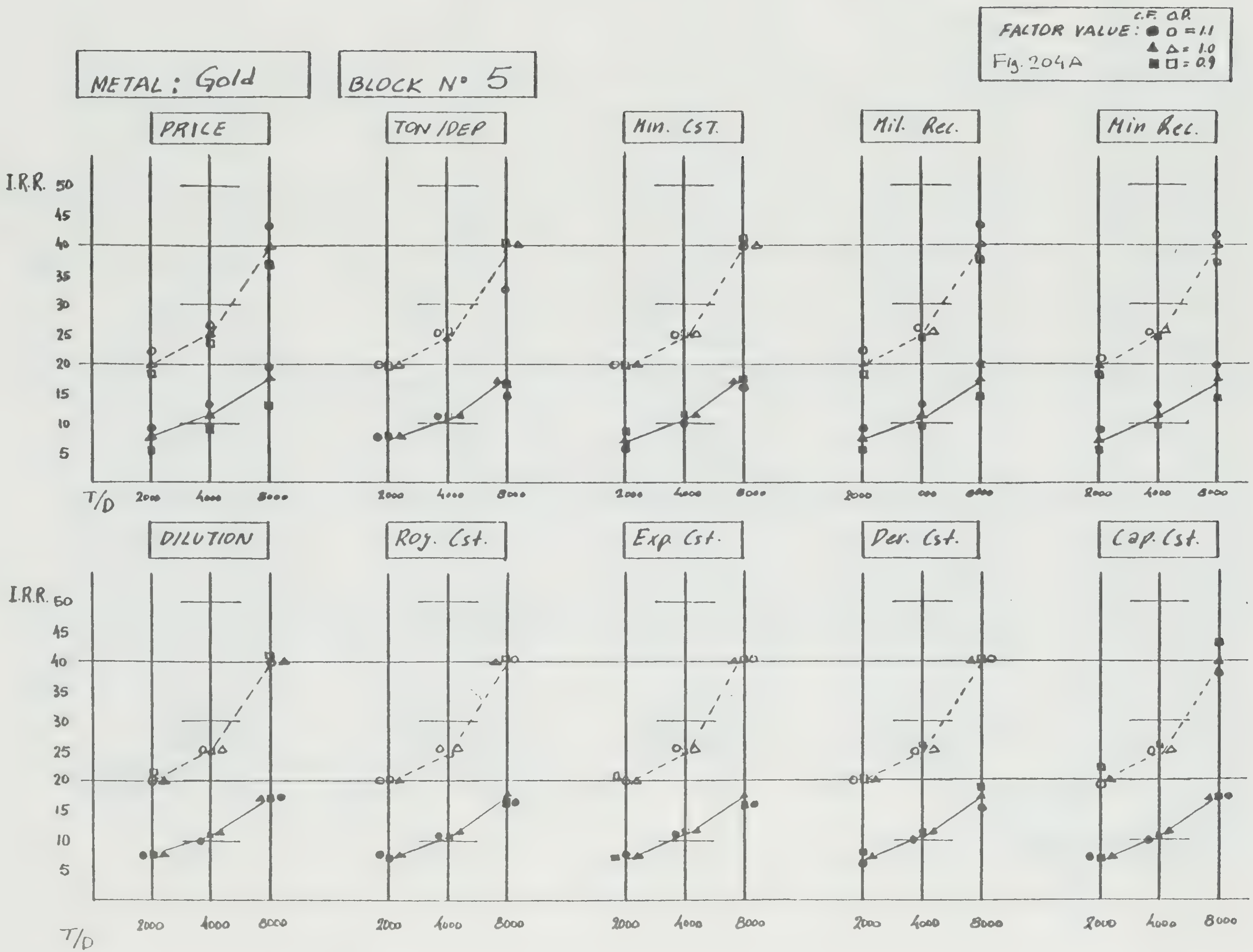


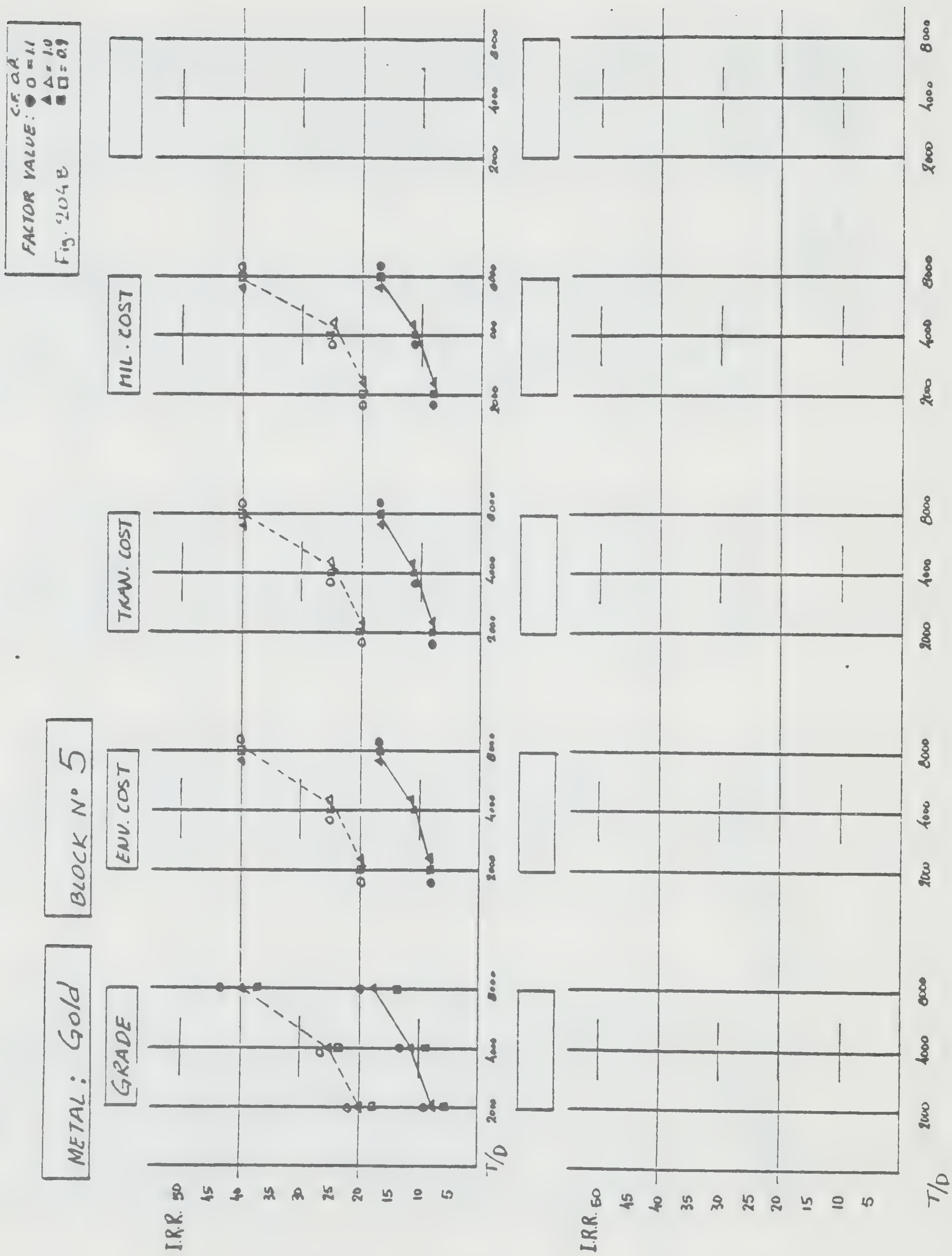
METAL : Gold
BLOCK N° 2
FACTOR VALUE: C.F. O.P. ● ○ = 1.1 ▲ △ = 1.0 ■ □ = 0.9
Fig. 202.A
PRICE
TON/DEP
Min. CST.
Mil. Rec.
Min Rec.
DILUTION
Roy. Cst.
Exp Cst.
Dev. Cst.
Cap. Cst.
I.R.R.
T/D
2000
4000
8000

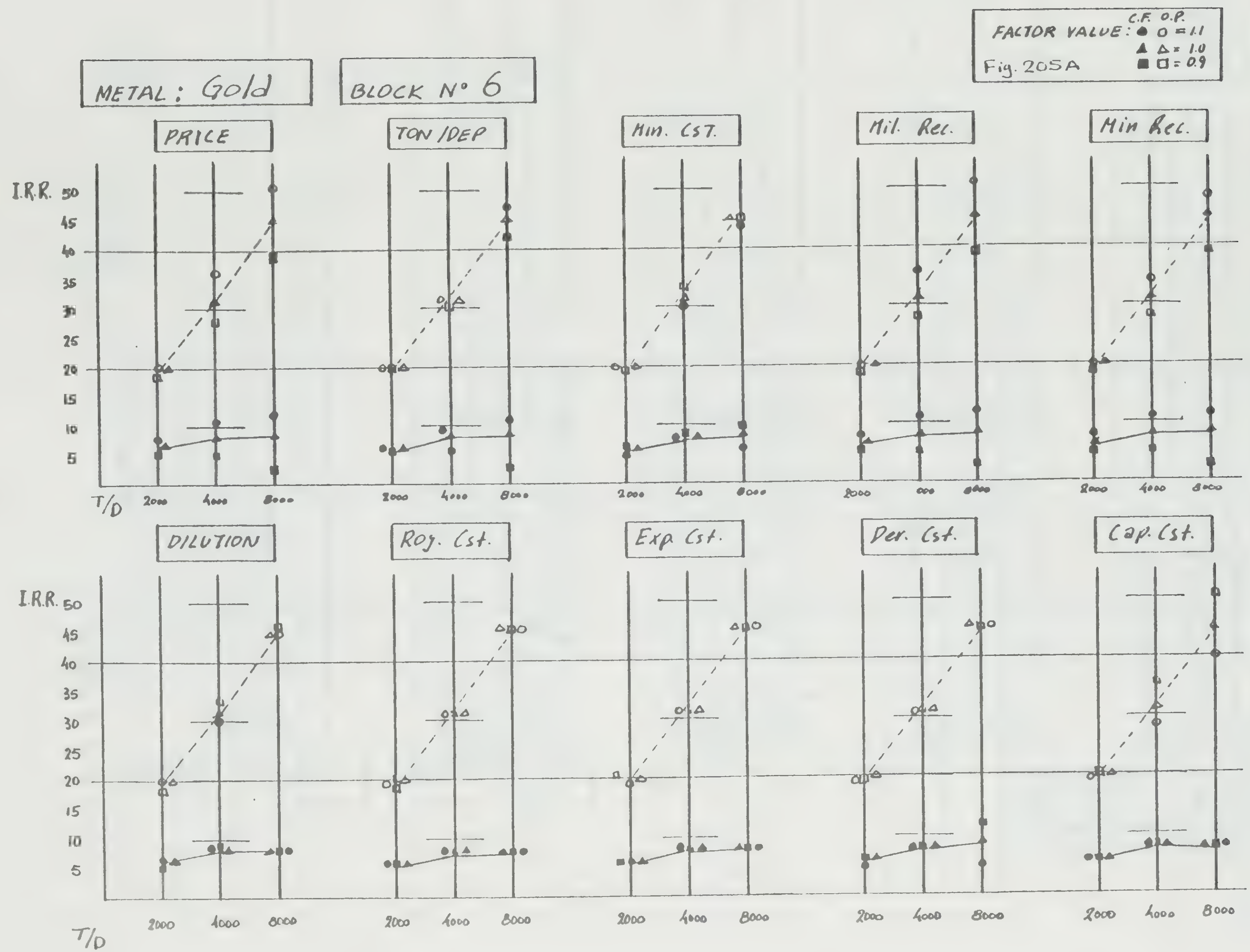

METAL : Gold
BLOCK N° 2
FACTOR VALUE: C.F. O.P.
● O = 1.1
▲ △ = 1.0
■ □ = 0.9
Fig. 202B
GRADE
ENV. COST
TRAN. COST
MIL. COST
I.R.R.
T/D


METAL: Gold
BLOCK N° 3
FACTOR VALUE: C.F. O.P. ● ○ = 1.1 ▲ △ = 1.0 ■ □ = 0.9
Fig. 203A
PRICE
TON/DEP
MIN. CST.
Mil. Rec.
Min Rec.
DILUTION
Roy. Cst.
Exp Cst.
Per. Cst.
Cap. Cst.
I.R.R.
T/D


METAL : Gold
BLOCK N° 3
FACTOR VALUE:
C.F. D.R.
● ○ = 1.1
▲ △ = 1.0
■ □ = 0.9
Fig. 203B
GRADE
ENV. COST
TRAN. COST
MIL. COST
I.R.R.
50
45
40
35
30
25
20
15
10
5
T/D
2000
4000
8000


METAL : Gold
BLOCK N° 5
FACTOR VALUE: C.F. ΔR.
● ○ = 1.1
▲ △ = 1.0
■ □ = 0.9
Fig. 204A
PRICE
TON/DEP
Min. CST.
Mil. Rec.
Min Rec.
DILUTION
Roy. Cst.
Exp Cst.
Dev. Cst.
Cap. Cst.
I.R.R.
50
45
40
35
30
25
20
15
10
5
T/D
2000
4000
8000


METAL: Gold
BLOCK N° 5
FACTOR VALUE: C.F. Q.R.
● ○ = 1.1
▲ △ = 1.0
■ □ = 0.9
Fig. 204B
GRADE
ENV. COST
TRAN. COST
MIL. COST
I.R.R.
50
45
40
35
30
25
20
15
10
5
T/D
2000
4000
8000


METAL : Gold
BLOCK N° 6
FACTOR VALUE : C.F. O.P.
● ○ = 1.1
▲ △ = 1.0
■ □ = 0.9
Fig. 205A
PRICE
TON/DEP
Min. CST.
Mil. Rec.
Min Rec.
DILUTION
Roy. Cst.
Exp Cst.
Der. Cst.
Cap. Cst.
I.R.R.
50
45
40
35
30
25
20
15
10
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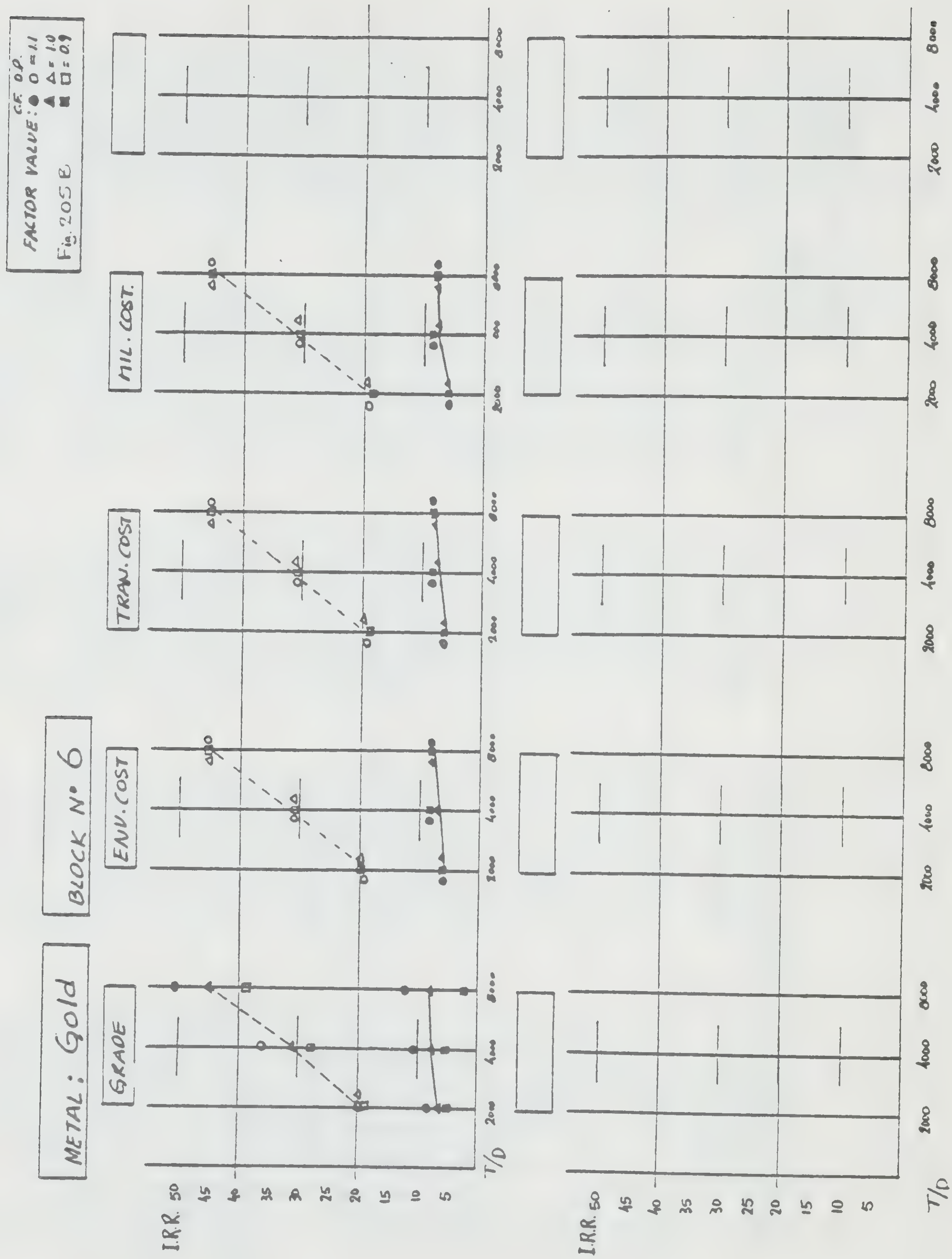
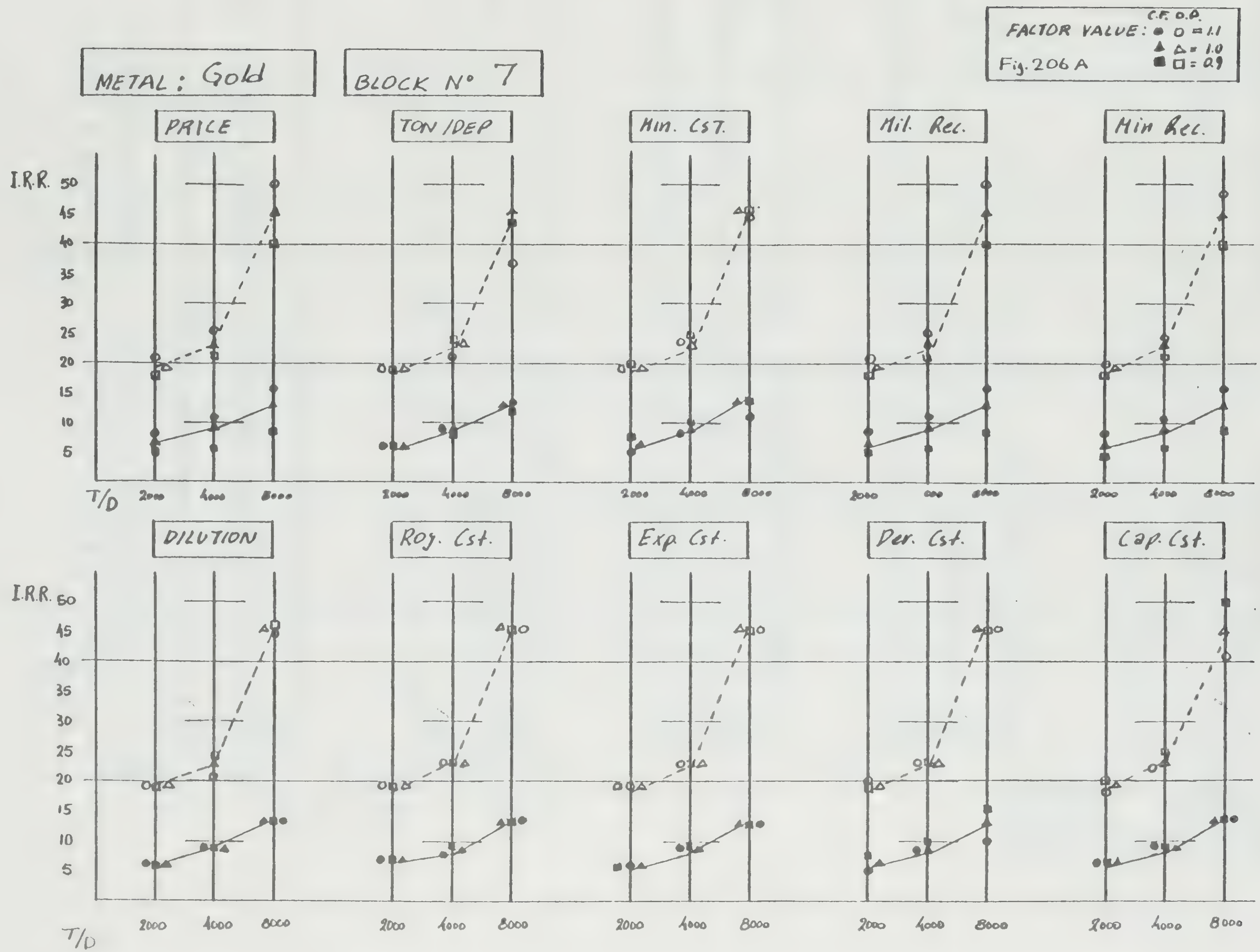
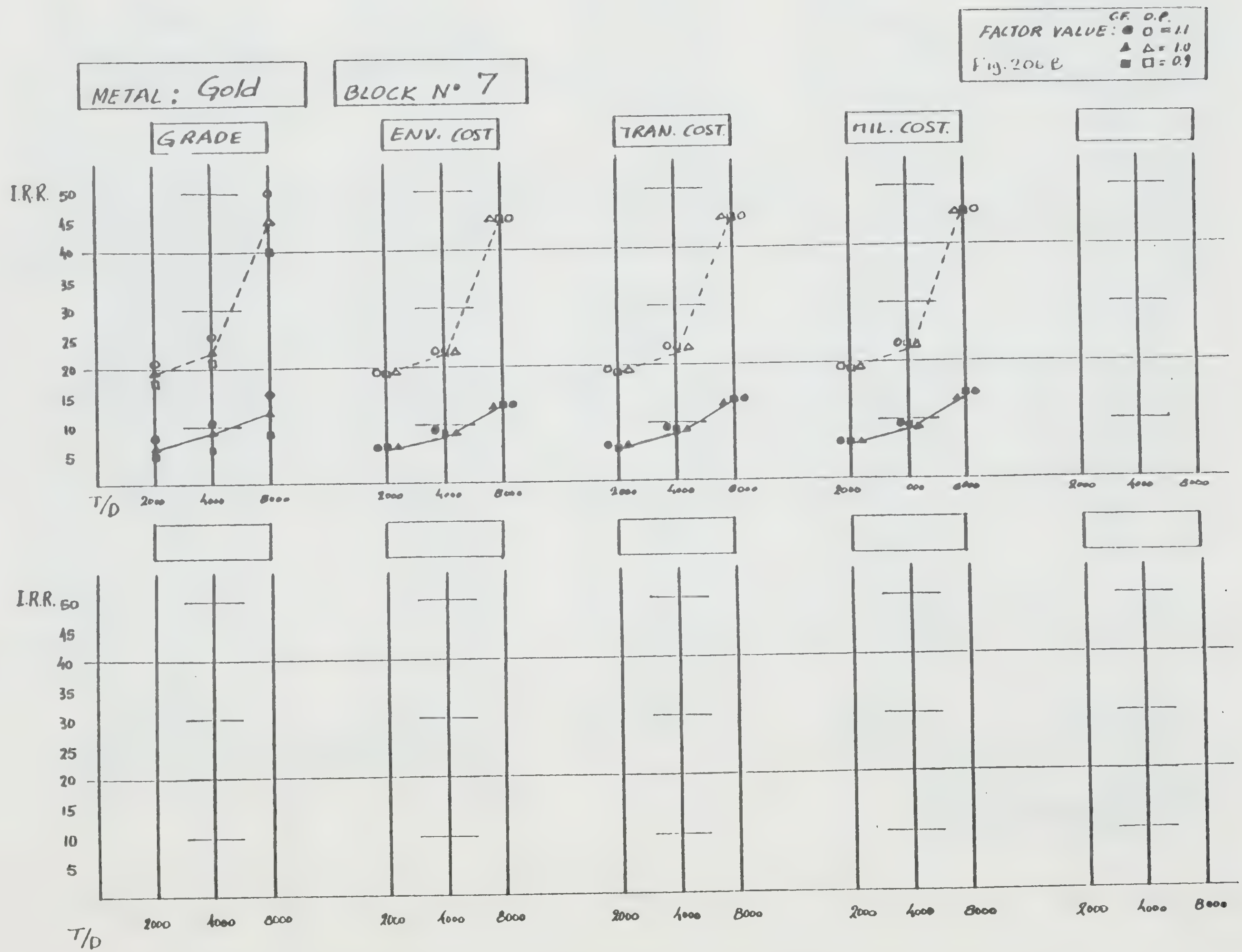
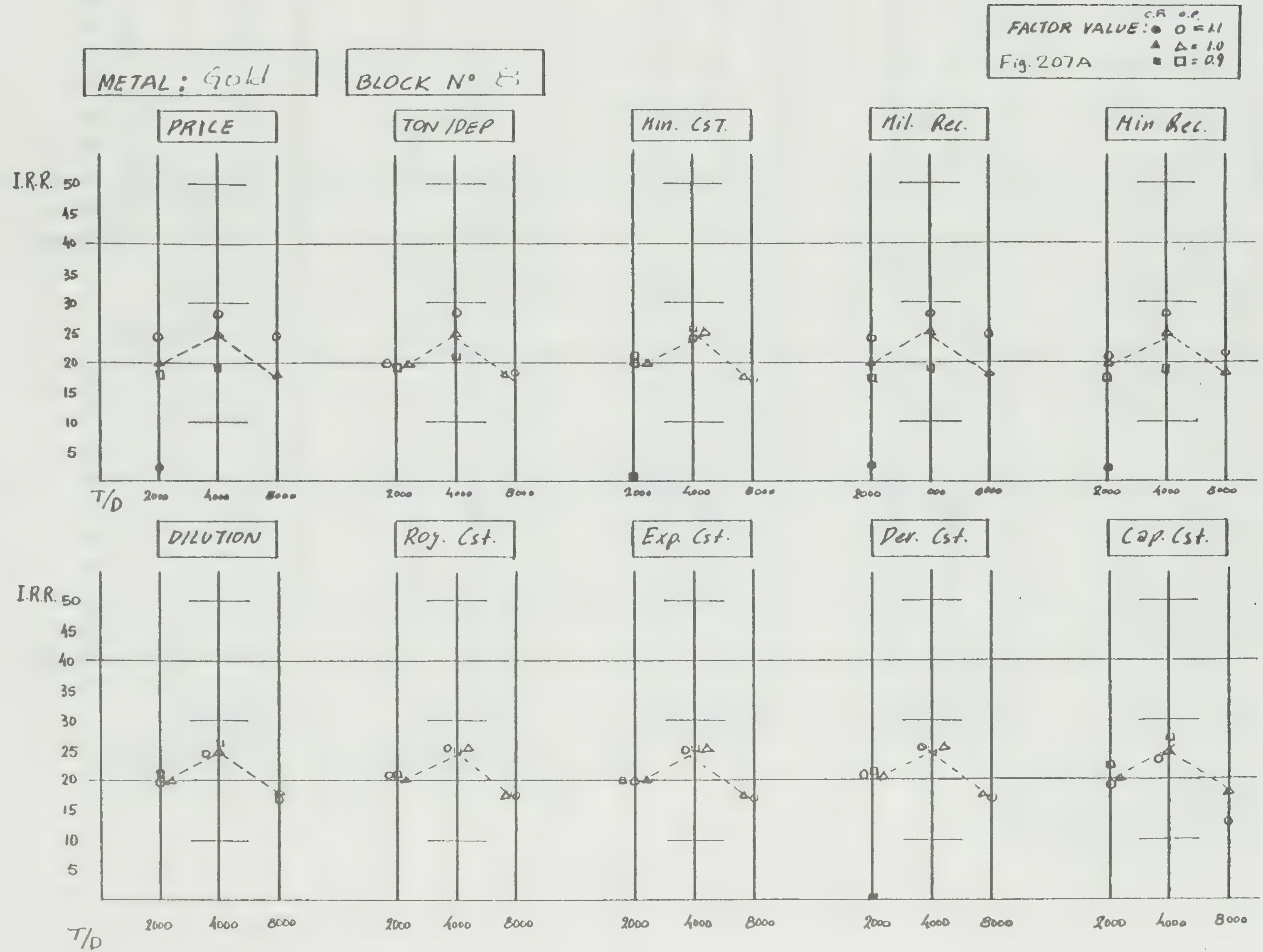
T/D
2000
4000
8000

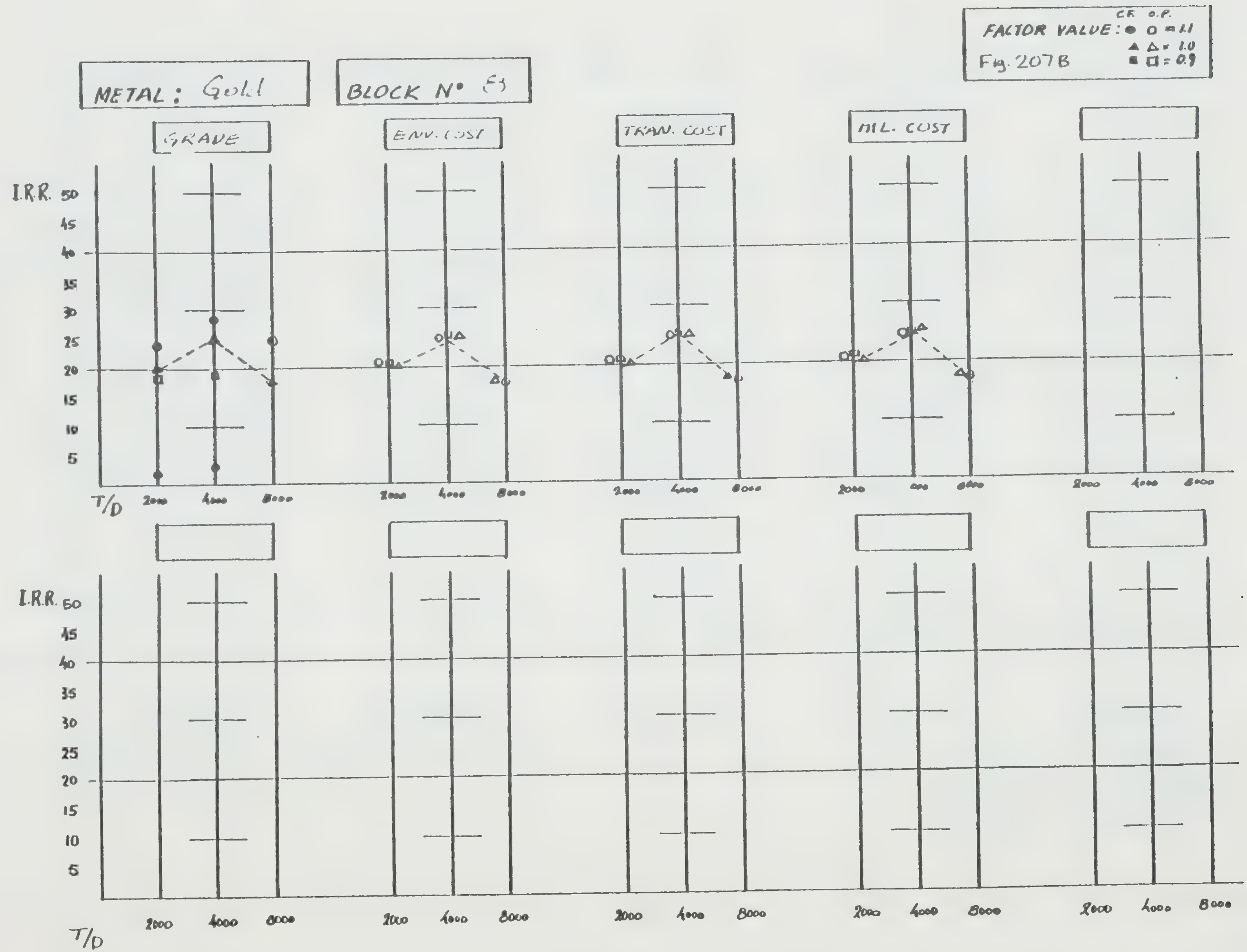

METAL: Gold
BLOCK N° 6
FACTOR VALUE: C.F. O.P.
● O = 1.1
▲ △ = 1.0
■ □ = 0.9
Fig. 205 B
GRADE
ENV. COST
TRAN. COST
MIL. COST
I.R.R.
50 45 40 35 30 25 20 15 10 5
T/D
2000 4000 8000

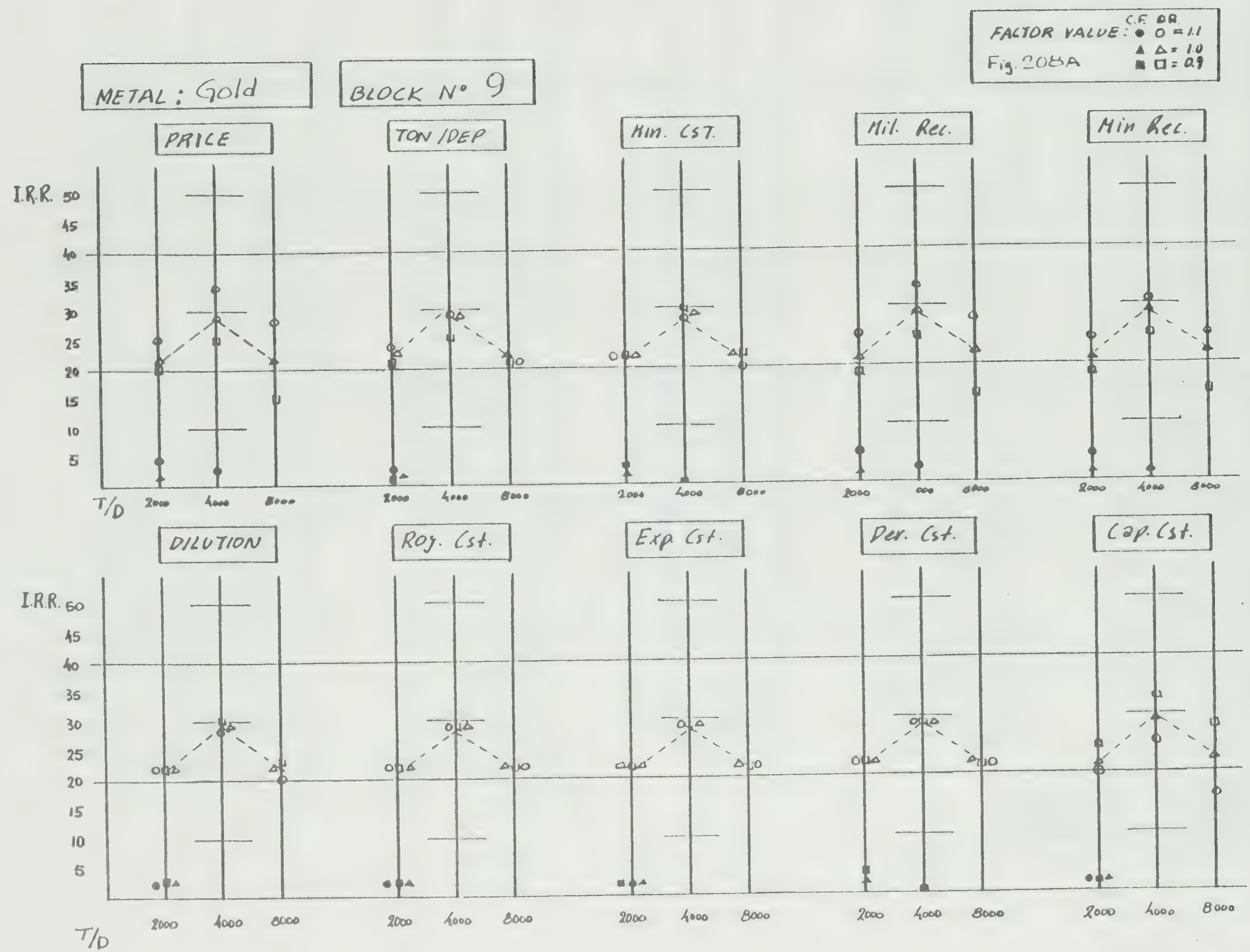

METAL : Gold
BLOCK N° 7
FACTOR VALUE: C.F. O.P. ● ○ = 1.1 ▲ △ = 1.0 ■ □ = 0.9
Fig. 206 A
PRICE
TON/DEP
Min. Cst.
Mil. Rec.
Min Rec.
DILUTION
Roy. Cst.
Exp Cst.
Der. Cst.
Cap. Cst.
I.R.R.
T/D
2000
4000
8000



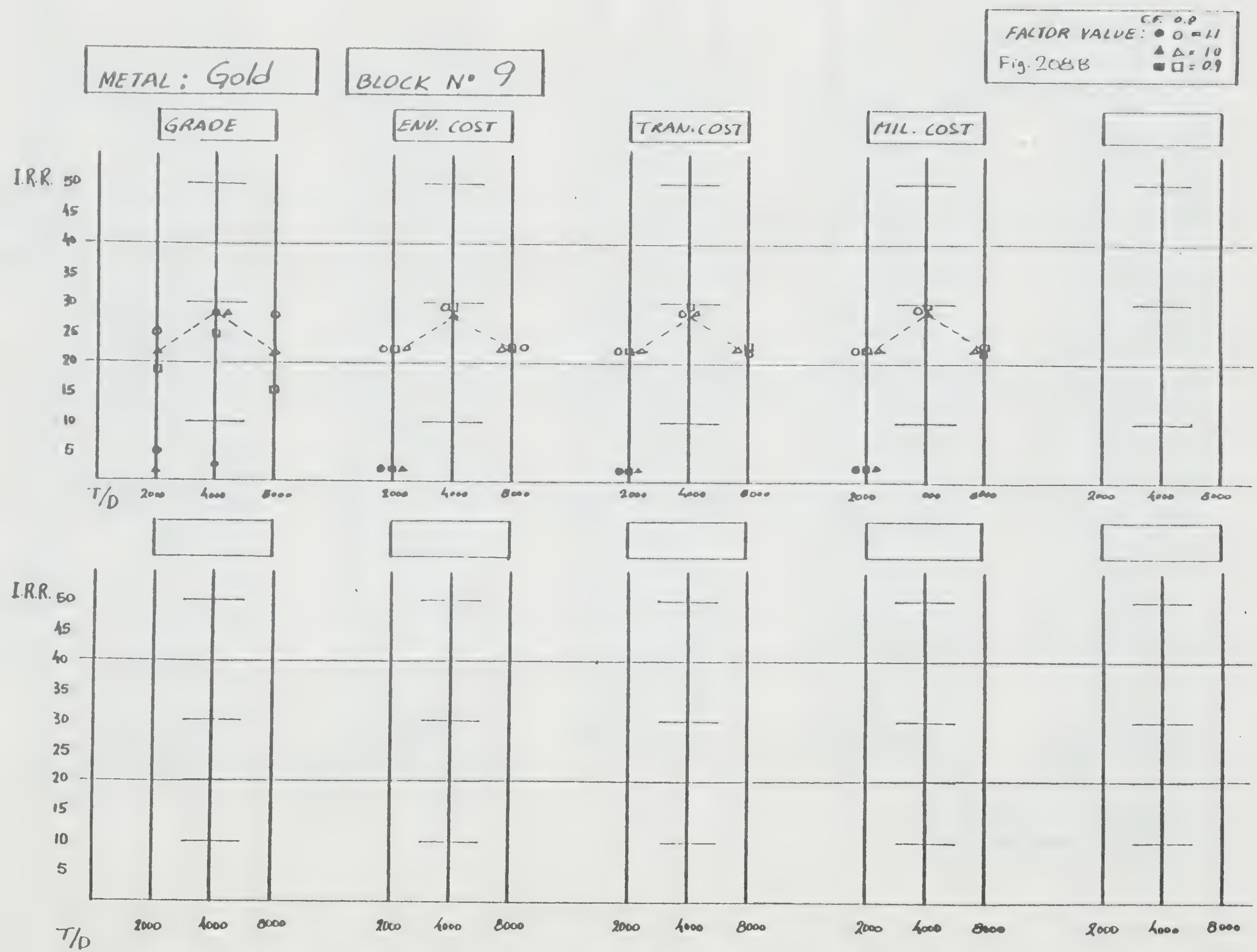
METAL: Gold
BLOCK N° 7
FACTOR VALUE: C.F. O.P. ● ○ = 1.1 ▲ △ = 1.0 ■ □ = 0.9
Fig. 206 B
GRADE
ENV. COST
TRAN. COST
MIL. COST.
I.R.R.
50
45
40
35
30
25
20
15
10
5
T/D
2000
4000
8000

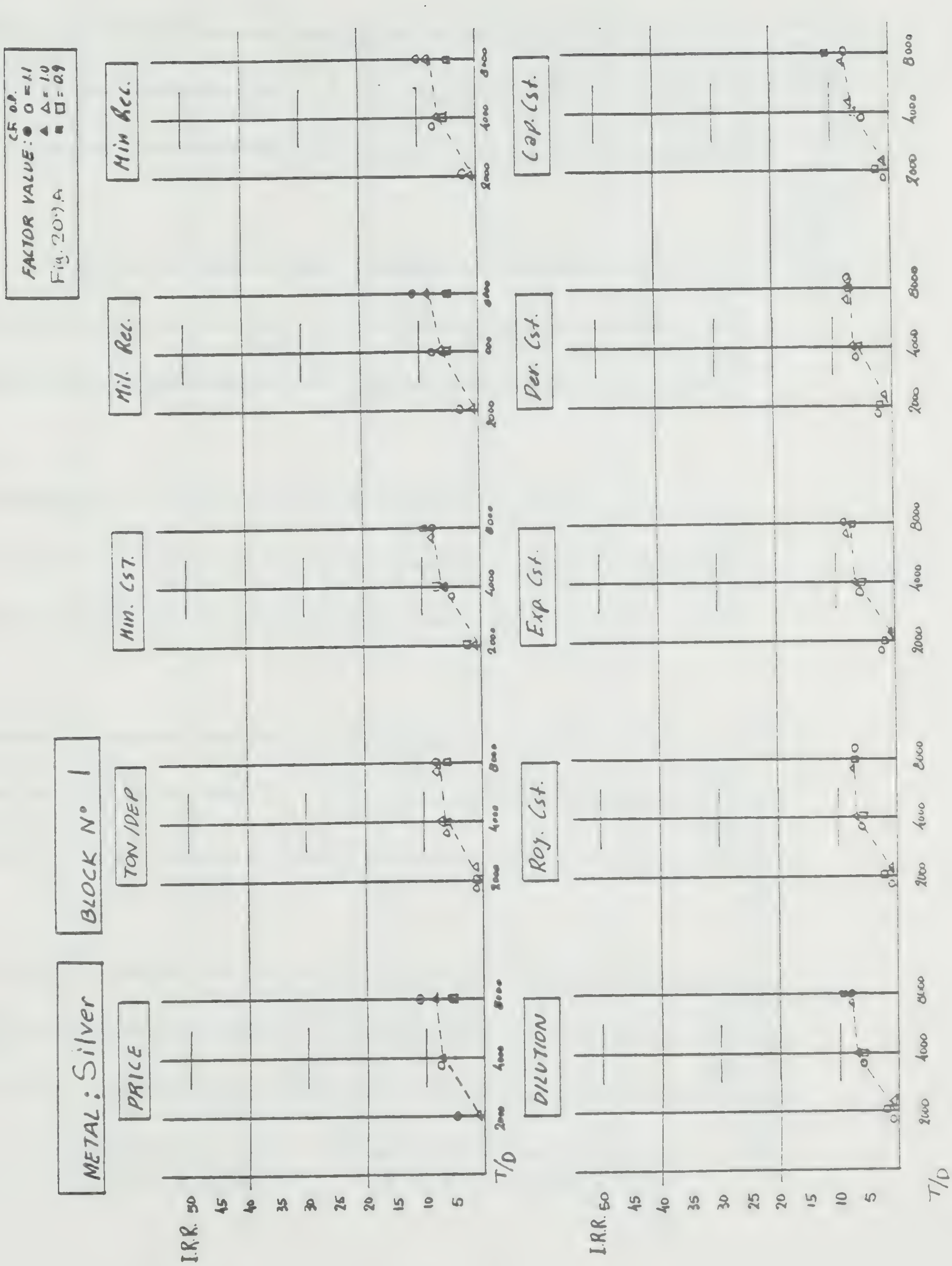

METAL: Gold
BLOCK N° 8
FACTOR VALUE: C.F. O.P. ● O = 1.1 ▲ Δ = 1.0 ■ □ = 0.9
Fig. 207A
PRICE
TON/DEP
Min. CST.
Mil. Rec.
Min Rec.
DILUTION
Roy. Cst.
Exp. Cst.
Dev. Cst.
Cap. Cst.
I.R.R.
T/D

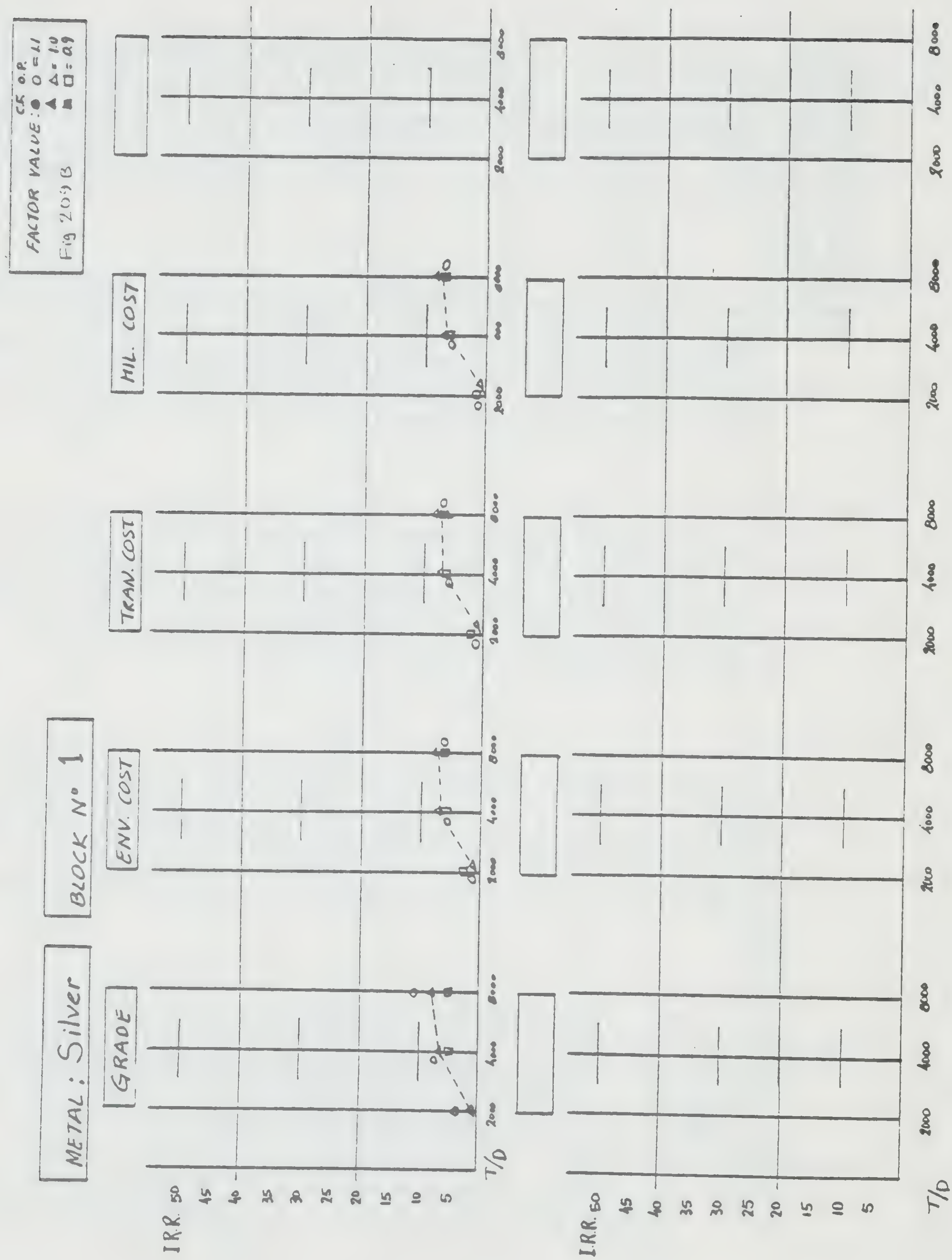

FACTOR VALUE :
C.F. O.P.
● O = 1.1
▲ Δ = 1.0
■ □ = 0.9
Fig. 207B
METAL : Gold
BLOCK N°
GRADE
ENV. COST
TRAN. COST
MIL. COST
I.R.R.
50
45
40
35
30
25
20
15
10
5
T/D
2000
4000
8000

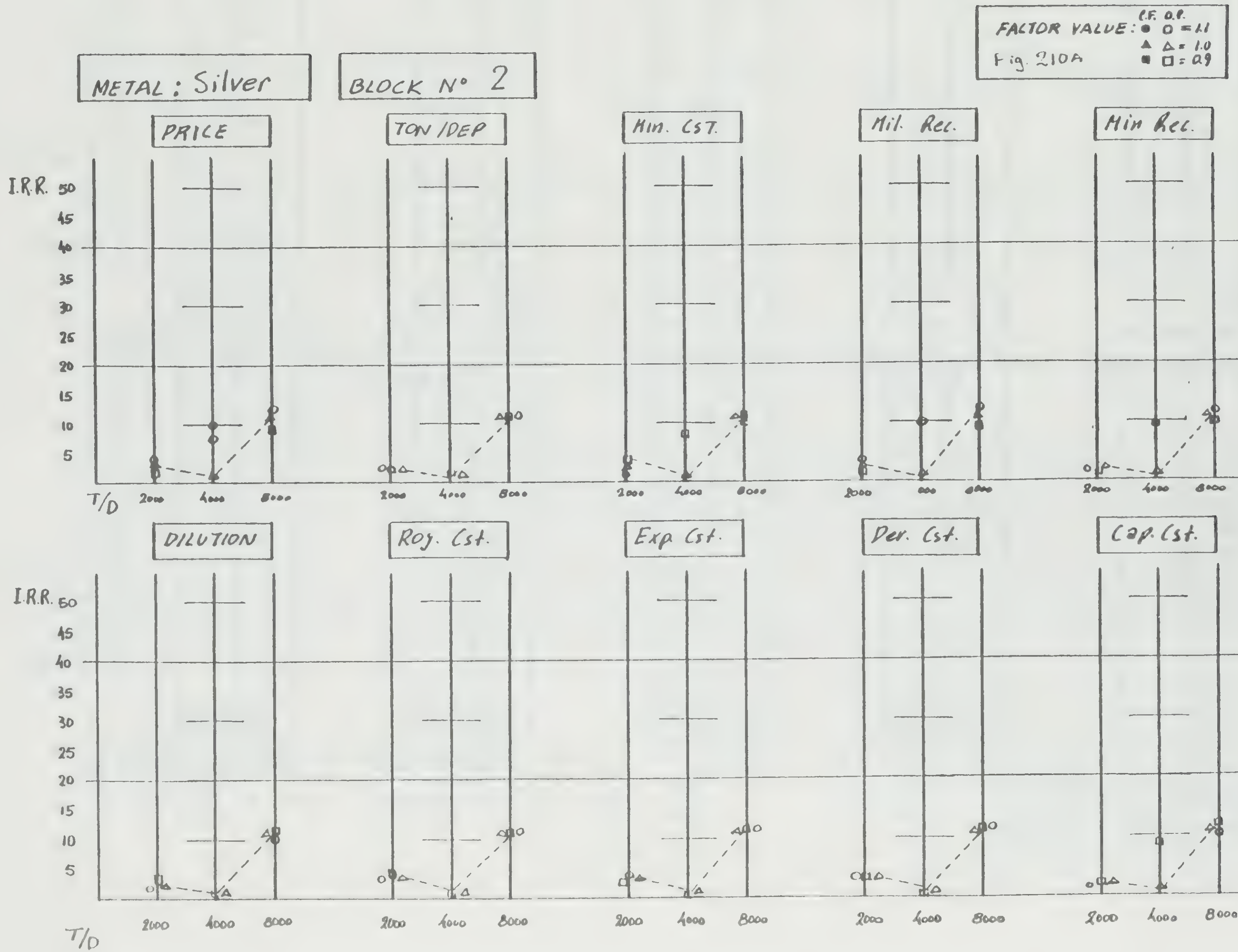


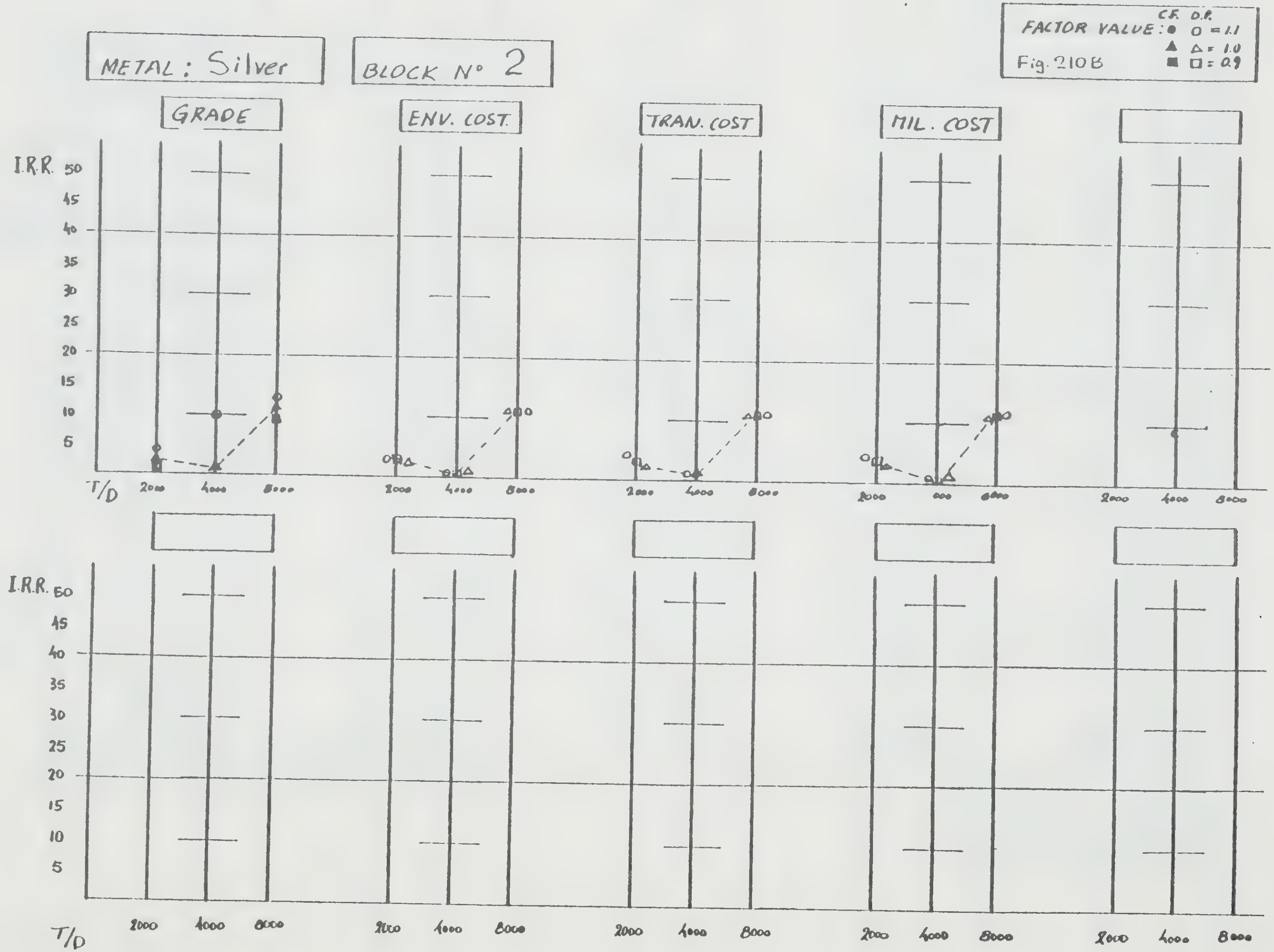
FACTOR VALUE: C.F. ● ▲ ■ ; O.R. O = 1.1 Δ = 1.0 □ = 0.9
Fig. 208A
METAL: Gold
BLOCK N° 9
PRICE
TON/DEP
Min. CST.
Mil. Rec.
Min Rec.
DILUTION
Roy. Cst.
Exp Cst.
Dev. Cst.
Cap. Cst.
I.R.R.
T/D

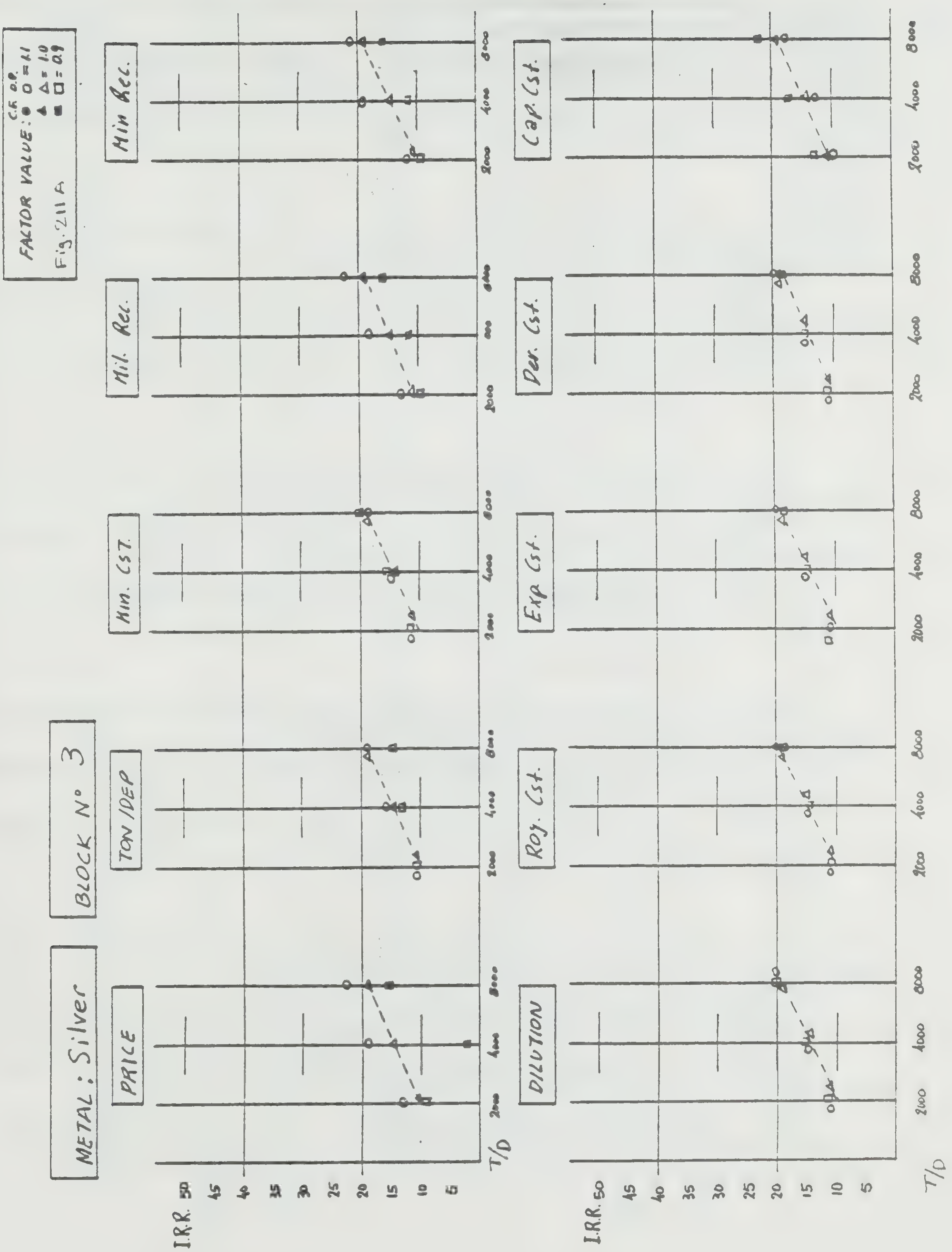

METAL: Gold
BLOCK Nº 9
FACTOR VALUE: C.F. 0.8 ● ○ = 1.1 ▲ △ = 1.0 ■ □ = 0.9
Fig. 208B
GRADE
ENV. COST
TRAN. COST
MIL. COST
I.R.R.
50
45
40
35
30
25
20
15
10
5
T/D
2000
4000
8000

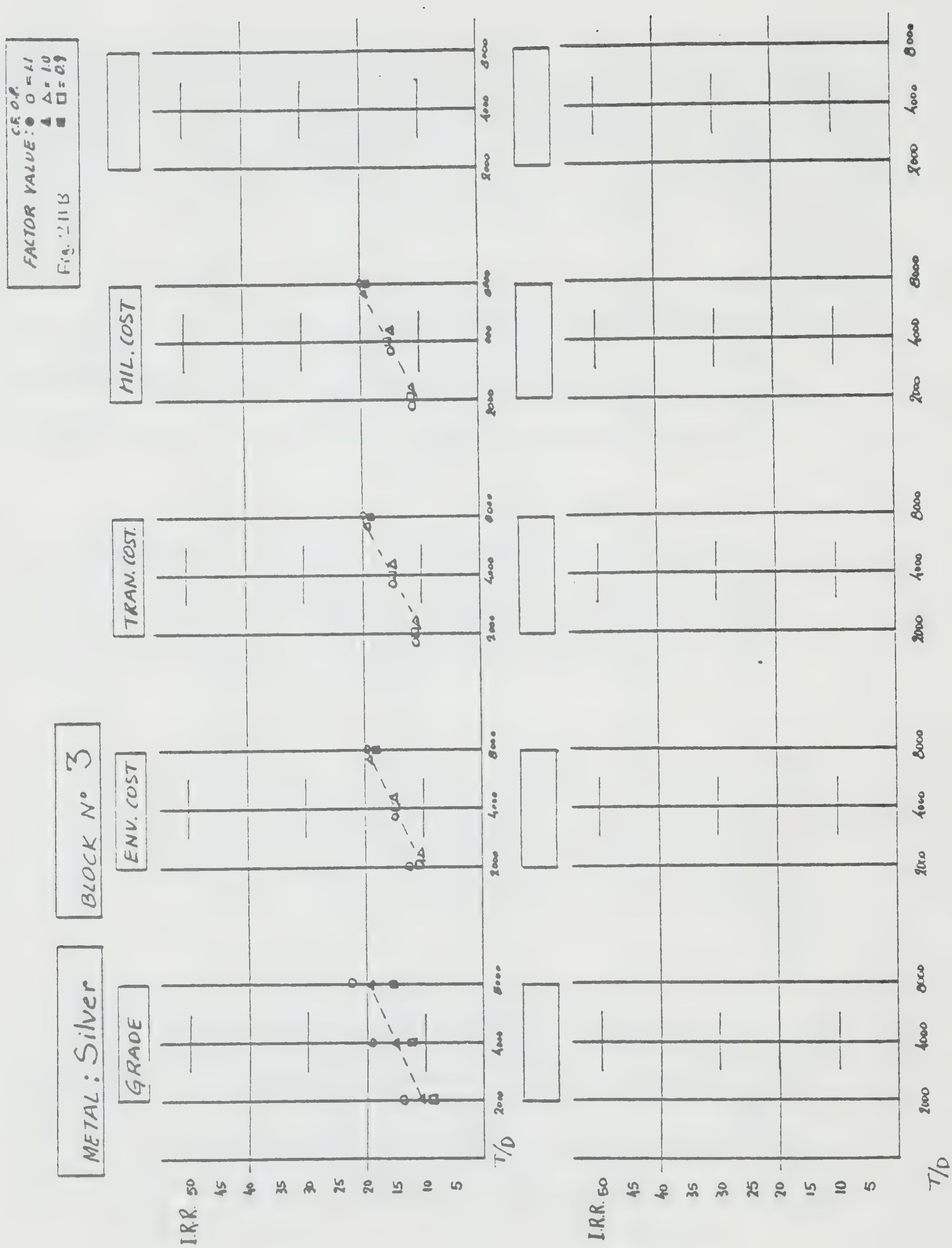

METAL : Silver
BLOCK N° 1
FACTOR VALUE: C.F. ● ▲ ■ O.P. O = 1.1 Δ = 1.0 □ = 0.9
Fig. 209.A
PRICE
TON/DEP
MIN. CST.
MIL. REC.
MIN REC.
DILUTION
ROY. CST.
EXP CST.
DEV. CST.
CAP. CST.
I.R.R.
50
45
40
35
30
25
20
15
10
5
T/D
2000
4000
8000


METAL : Silver
BLOCK N° 1
FACTOR VALUE : CF O.P.
● ○ = 1.1
▲ △ = 1.0
■ □ = 0.9
Fig 209 B
GRADE
ENV. COST
TRAN. COST
MIL. COST
I.R.R. 50 45 40 35 30 25 20 15 10 5
T/D
2000 4000 8000

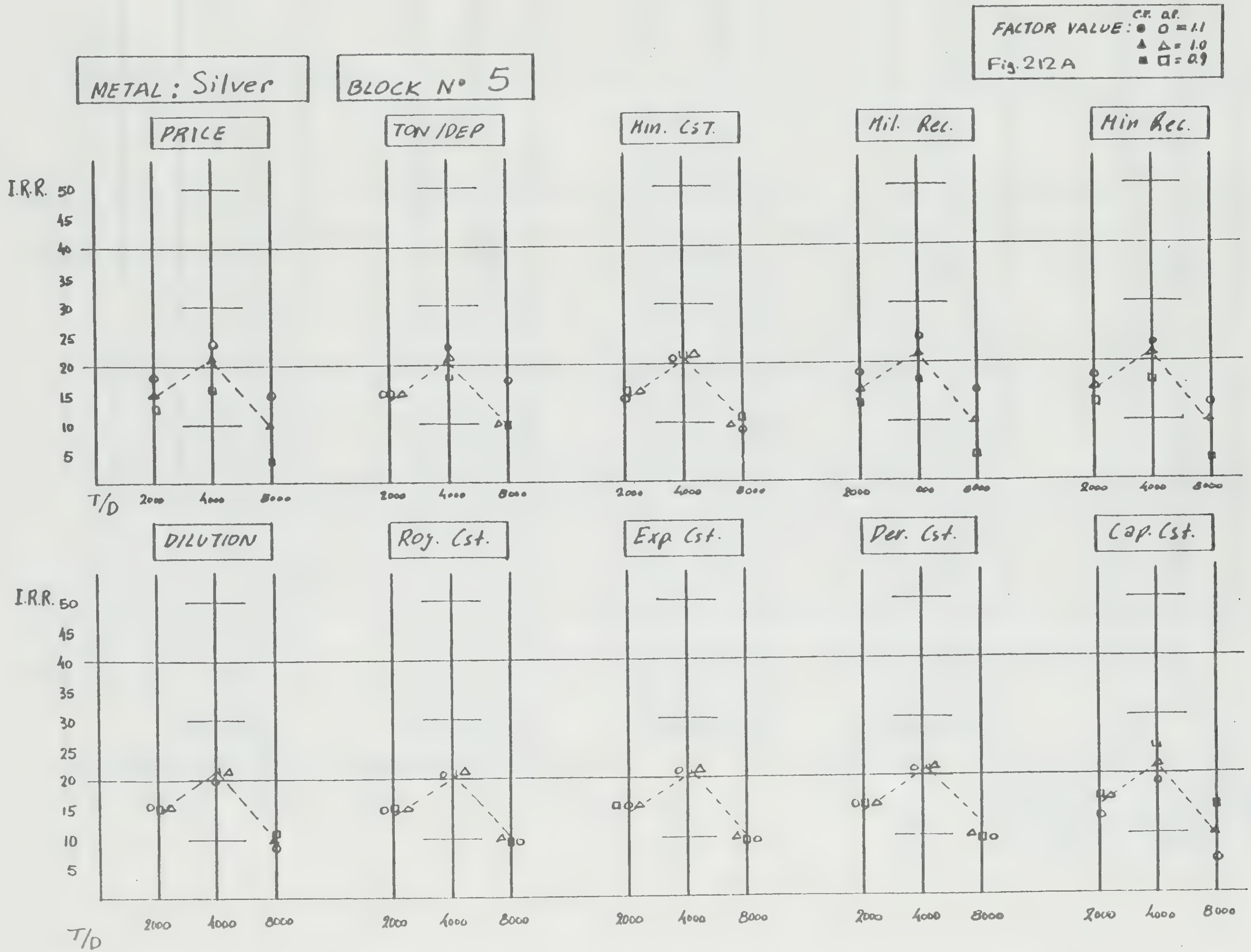

METAL : Silver
BLOCK N° 2
FACTOR VALUE: C.F. ● O.P. O = 1.1; ▲ △ = 1.0; ■ □ = 0.9
Fig. 210A
PRICE
TON/DEP
Min. CST.
Mil. Rec.
Min Rec.
DILUTION
Roy. Cst.
Exp Cst.
Dev. Cst.
Cap. Cst.
I.R.R.
50
45
40
35
30
25
20
15
10
5
T/D
2000
4000
8000

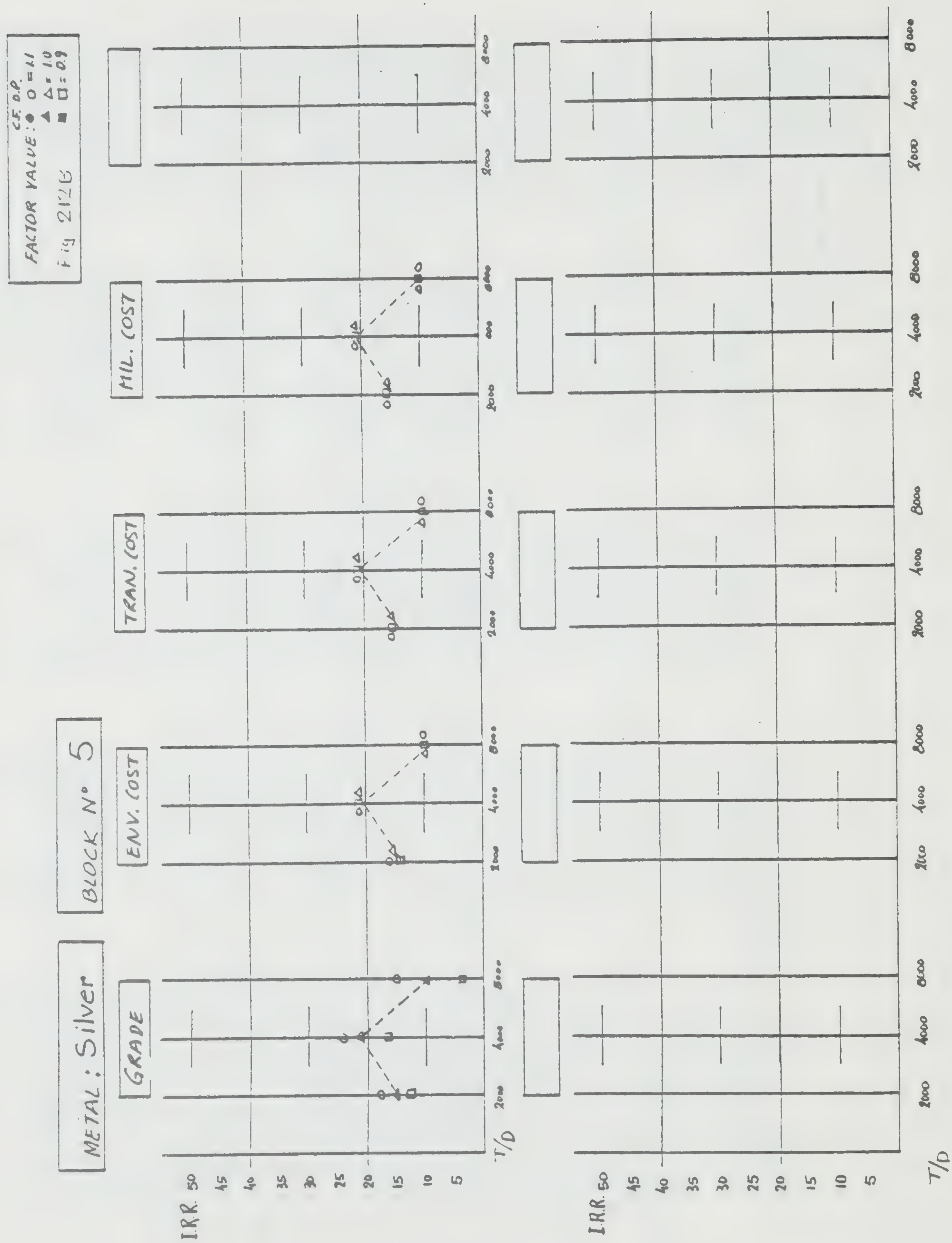

METAL : Silver
BLOCK N° 2
FACTOR VALUE : C.F. D.P.
● O = 1.1
▲ Δ = 1.0
■ □ = 0.9
Fig. 210B
GRADE
ENV. COST
TRAN. COST
MIL. COST
I.R.R.
50
45
40
35
30
25
20
15
10
5
T/D
2000
4000
8000

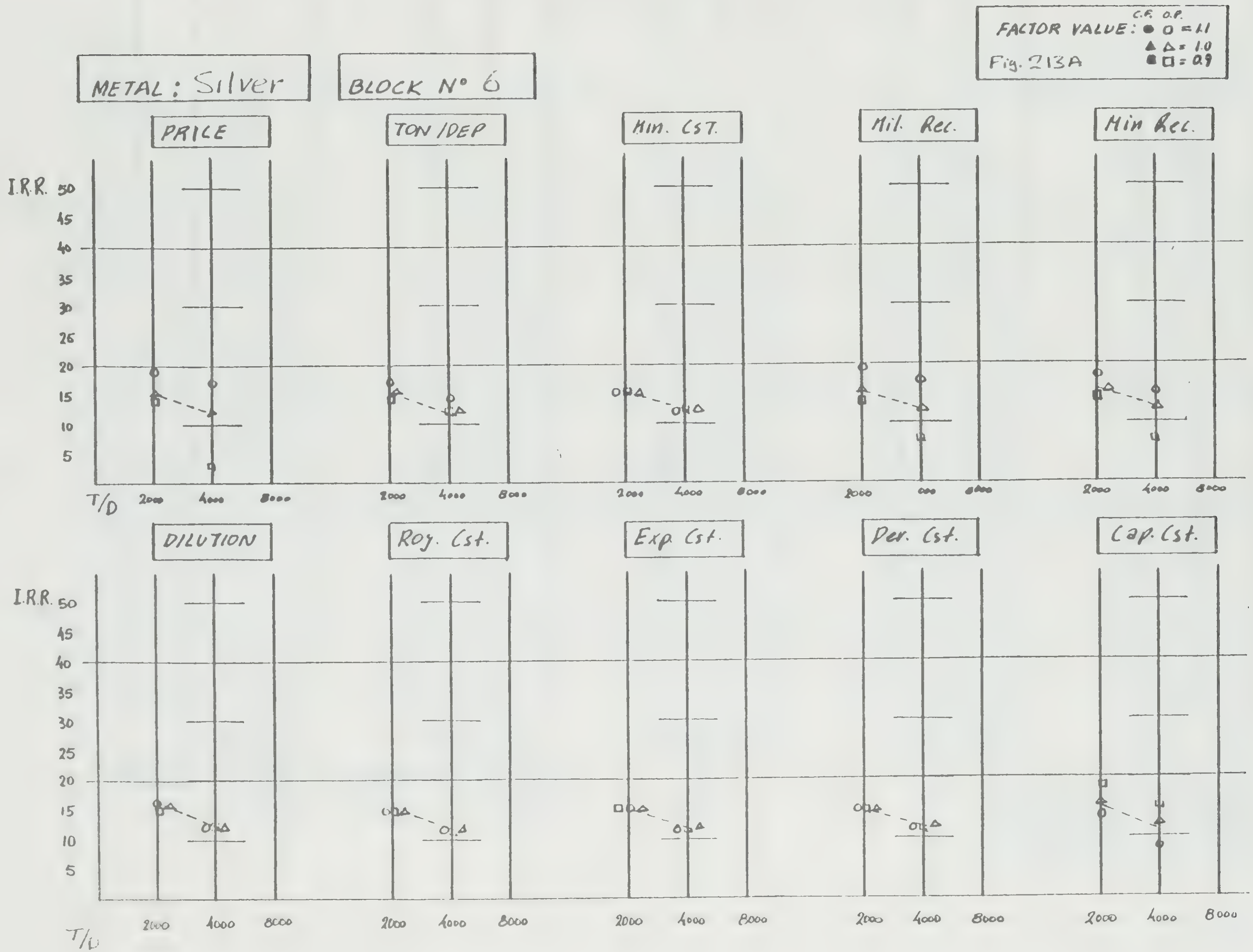

METAL : Silver
BLOCK N° 3
FACTOR VALUE: C.F. O.P. ● ○ = 1.1 ▲ △ = 1.0 ■ □ = 0.9
Fig. 211 A
PRICE
TON/DEP
Min. CST.
Mil. Rec.
Min Rec.
DILUTION
Roj. Cst.
Exp Cst.
Der. Cst.
Cap. Cst.
I.R.R.
50
45
40
35
30
25
20
15
10
5
T/D
2000
4000
8000

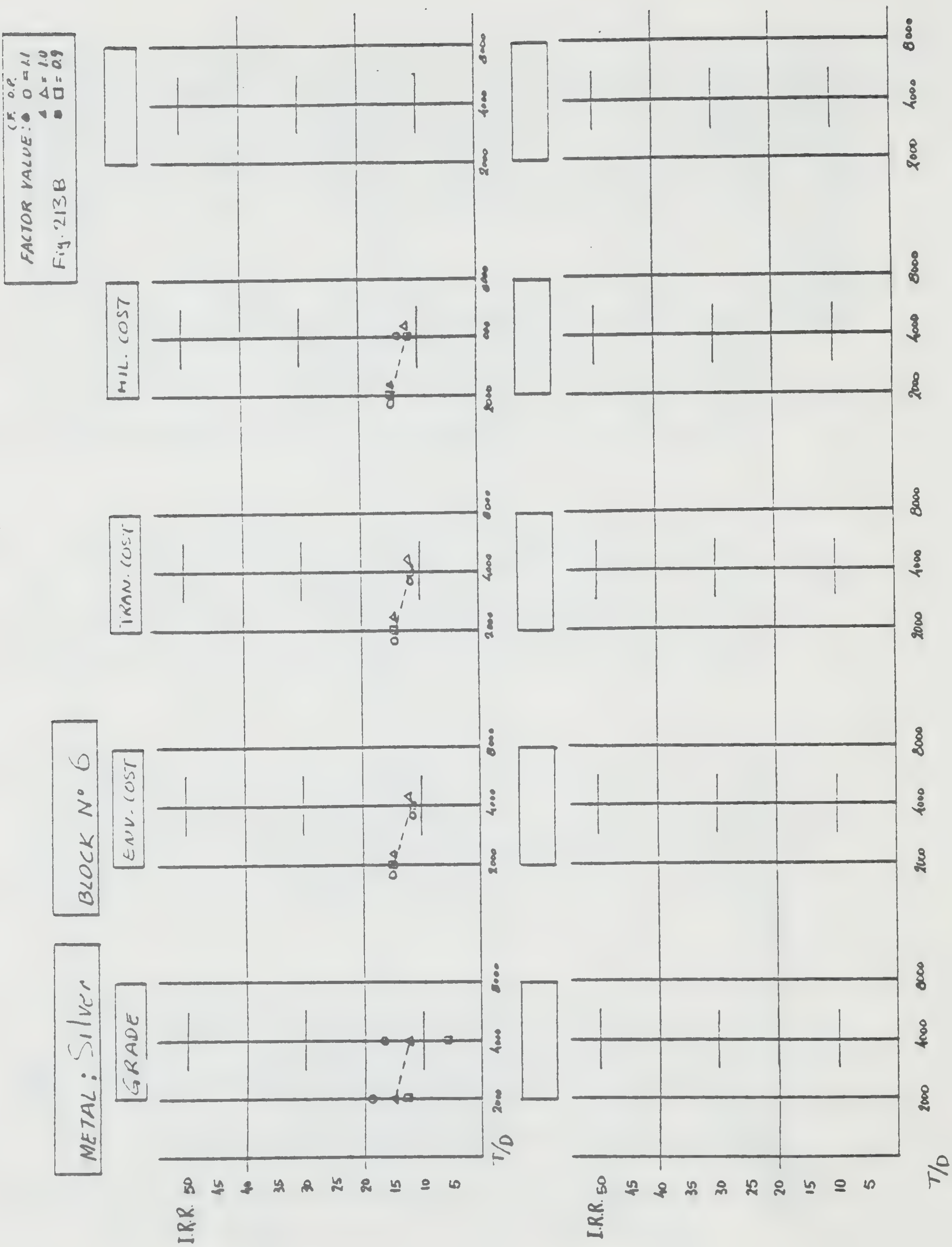


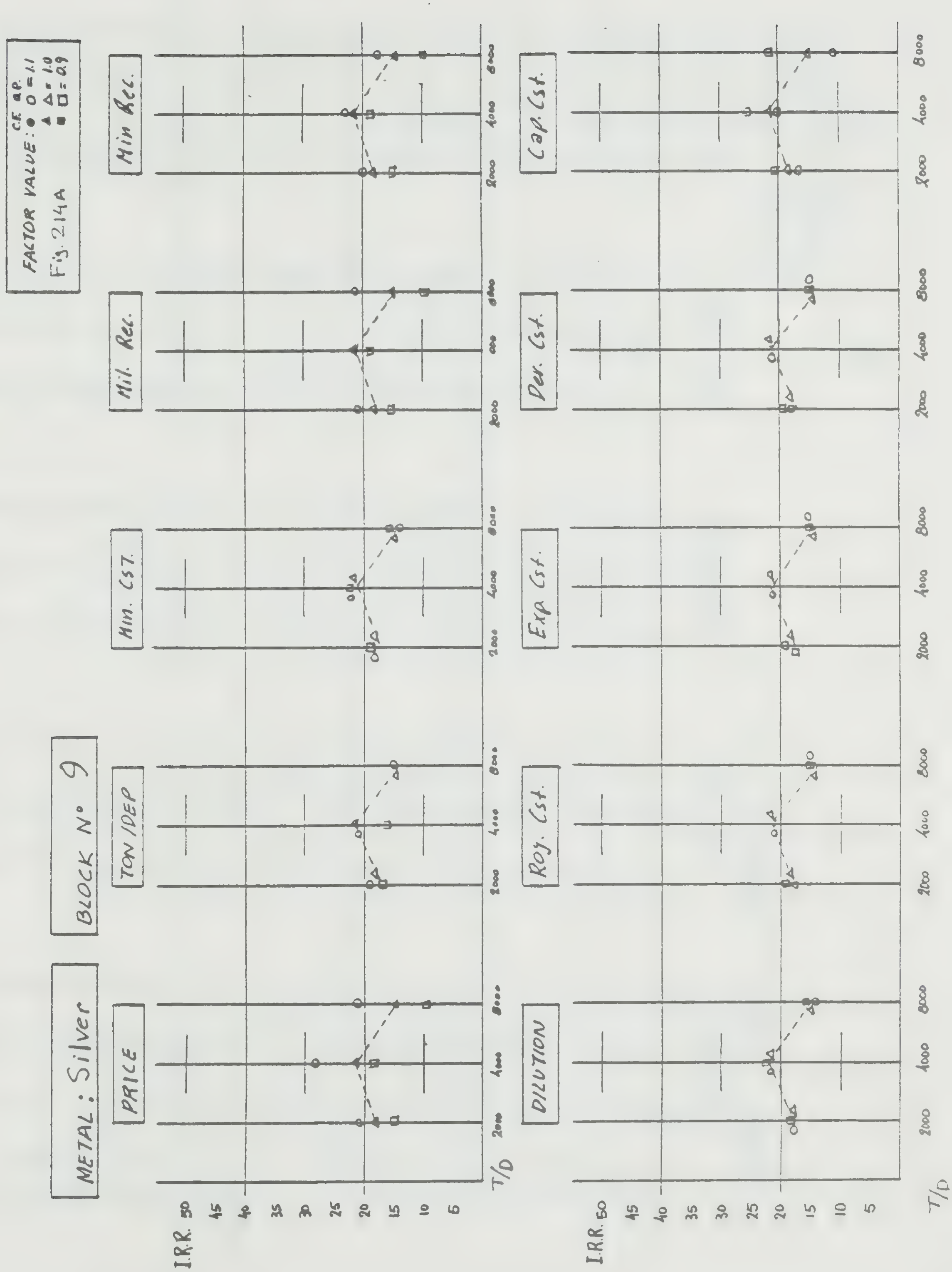
METAL : Silver
BLOCK N° 3
FACTOR VALUE : C.R. O.P.
● ○ = 1.1
▲ △ = 1.0
■ □ = 0.9
Fig. 21B
GRADE
ENV. COST
TRAN. COST
MIL. COST
I.R.R.
T/D


METAL : Silver
BLOCK N° 5
FACTOR VALUE: C.F. ● O.F. ○ = 1.1
▲ △ = 1.0
■ □ = 0.9
Fig. 212A
PRICE
TON /DEP
Min. CST.
Mil. Rec.
Min Rec.
DILUTION
Roy. Cst.
Exp Cst.
Dev. Cst.
Cap. Cst.
I.R.R.
50
45
40
35
30
25
20
15
10
5
T/D
2000
4000
8000

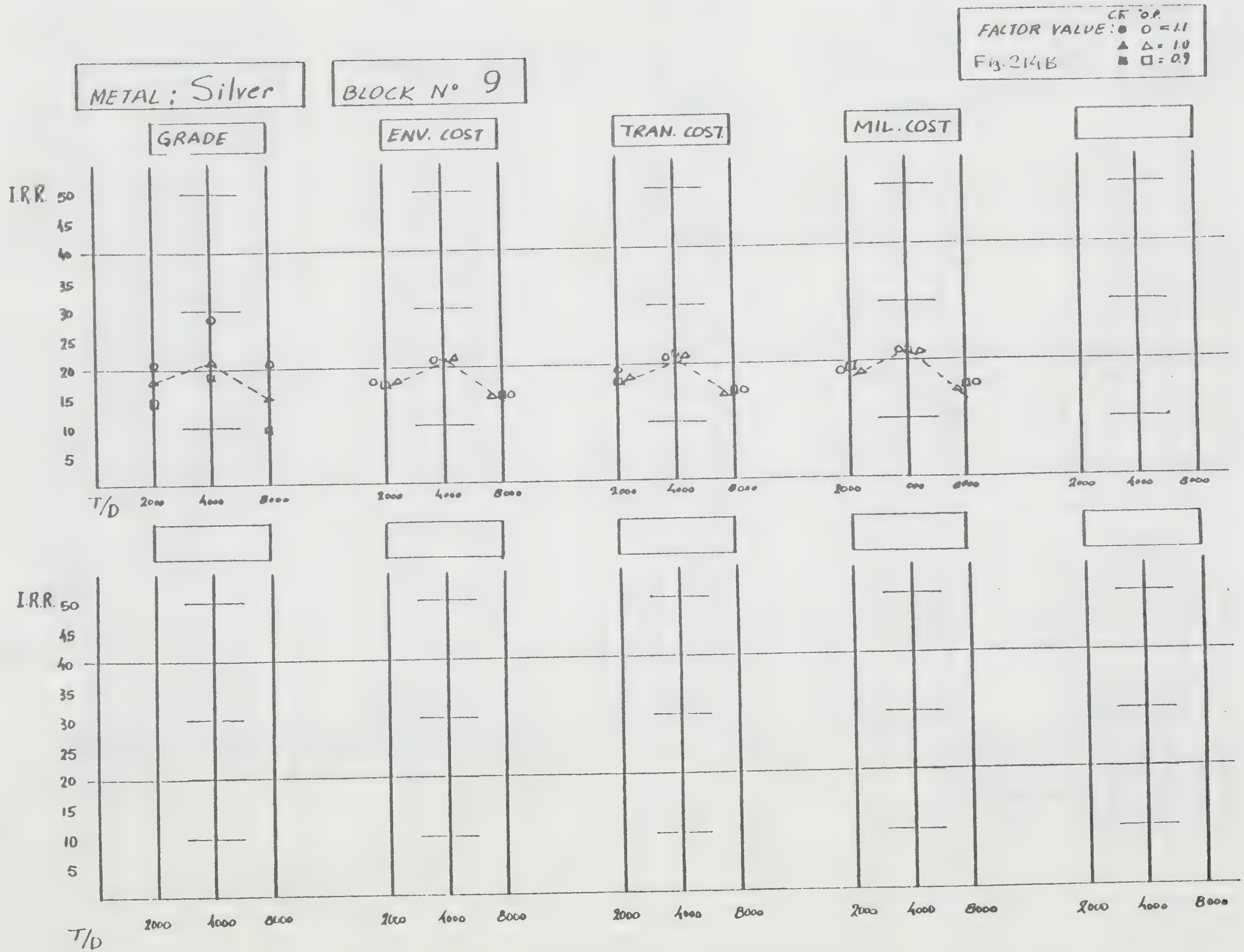

METAL: Silver
BLOCK N° 5
FACTOR VALUE: C.F. O.P. ● O = 1.1 ▲ Δ = 1.0 ■ □ = 0.9
Fig 212B
GRADE
ENV. COST
TRAN. COST
MIL. COST
I.R.R.
50 45 40 35 30 25 20 15 10 5
T/D
2000 4000 8000

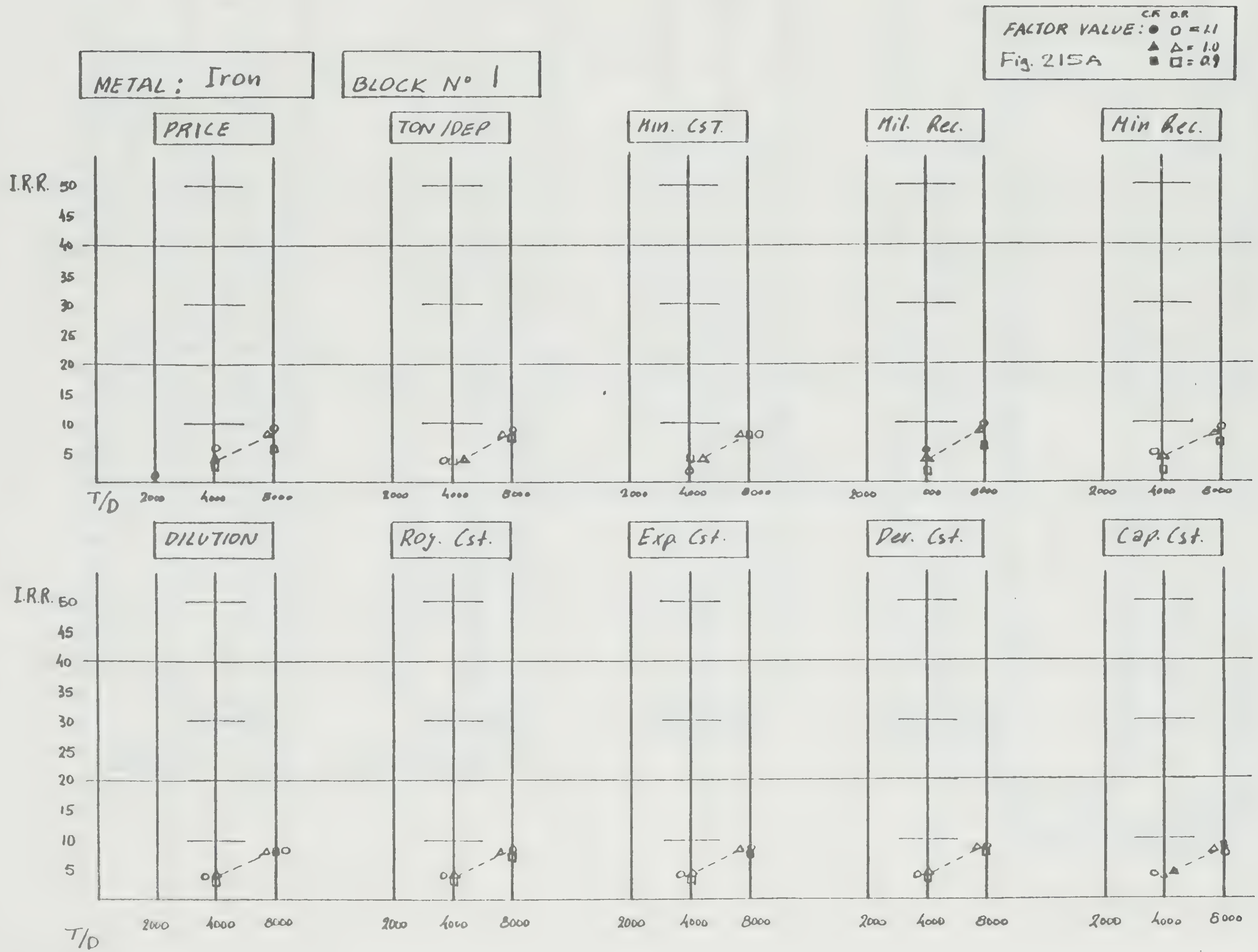

FACTOR VALUE: C.F. ● O.P. ○ = 1.1 ▲ △ = 1.0 ■ □ = 0.9
Fig. 213A
METAL: Silver
BLOCK N° 6
PRICE
TON/DEP
Min. Cst.
Mil. Rec.
Min Rec.
DILUTION
Roy. Cst.
Exp Cst.
Dev. Cst.
Cap. Cst.
I.R.R.
50
45
40
35
30
25
20
15
10
5
T/D
2000
4000
8000

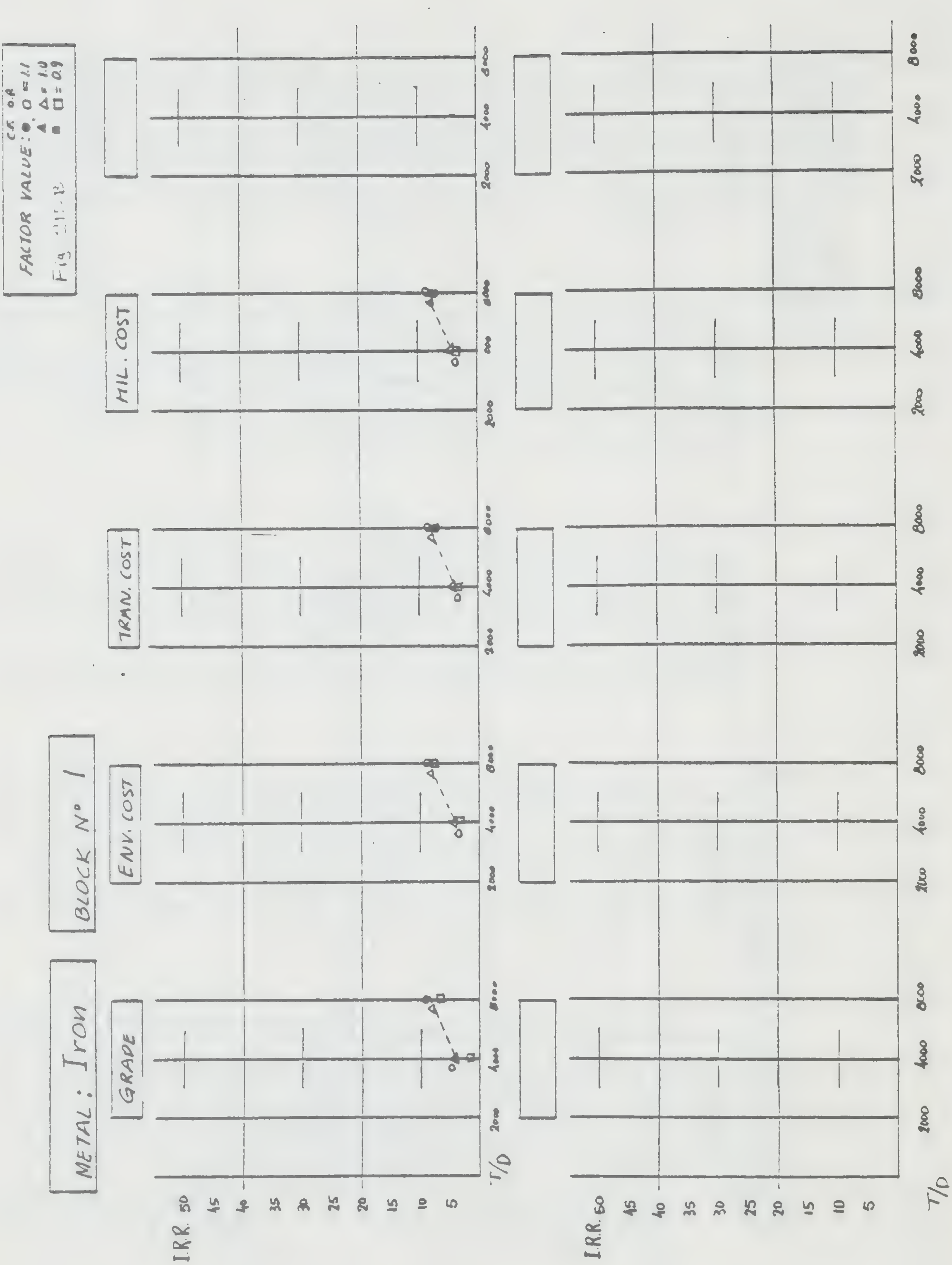

METAL: Silver
BLOCK N° 6
FACTOR VALUE: C.F. O.P.
● O = 1.1
▲ Δ = 1.0
■ □ = 0.9
Fig: 213B
GRADE
ENV. COST
TRAN. COST
MIL. COST
I.R.R.
T/D
2000
4000
8000
50
45
40
35
30
25
20
15
10
5

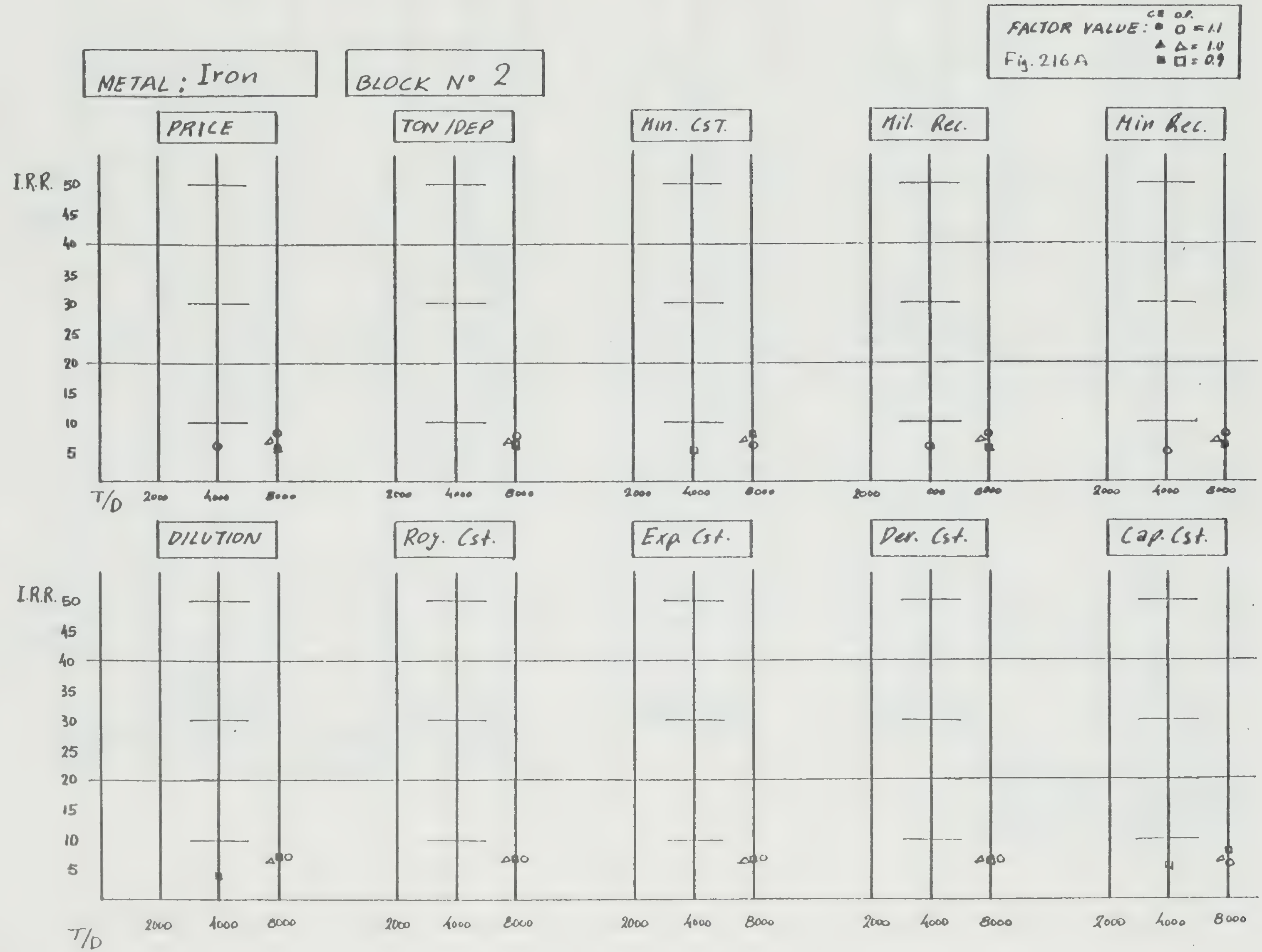


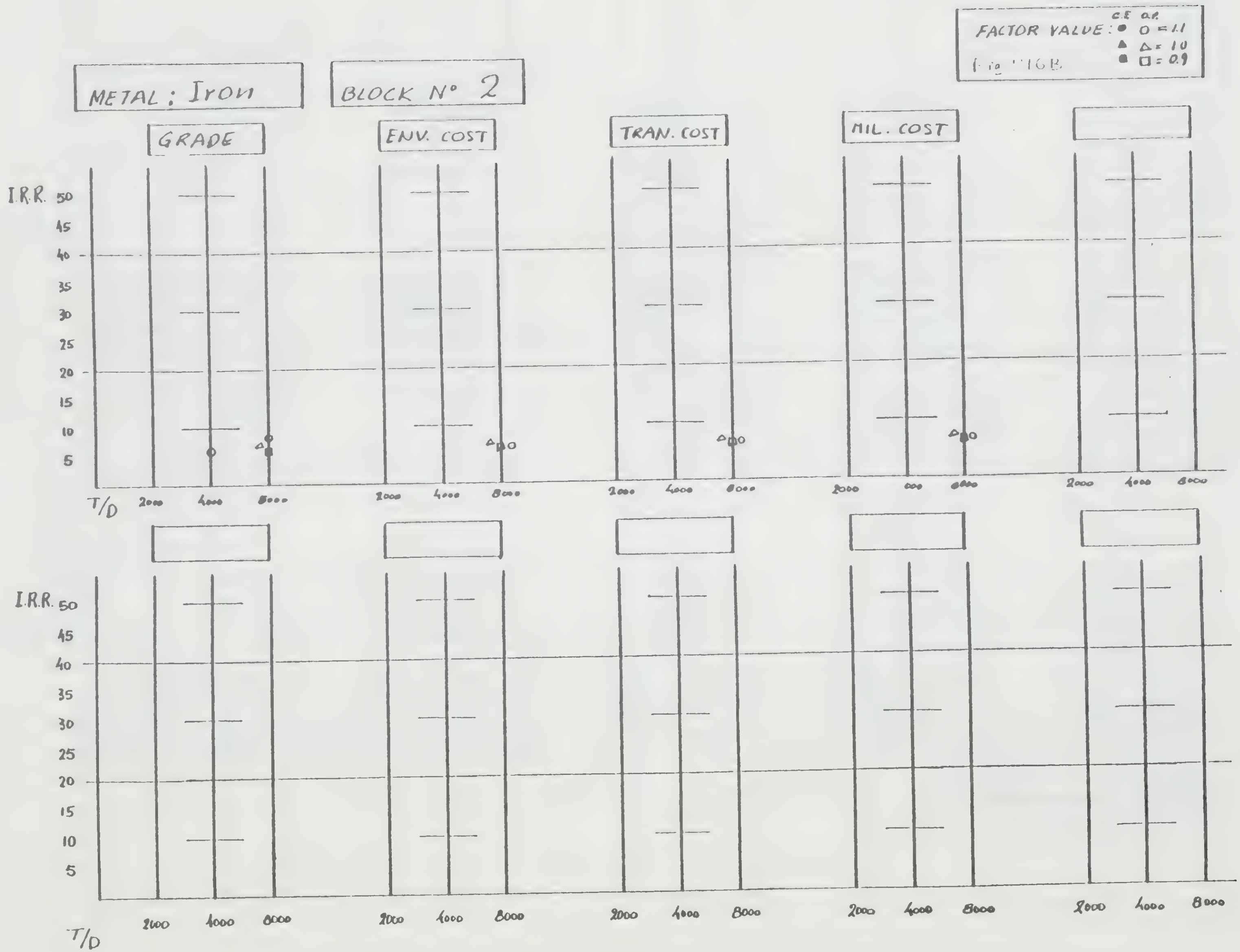
METAL: Silver
BLOCK N° 9
FACTOR VALUE: C.F. A.P. ● ○ = 1.1 ▲ △ = 1.0 ■ □ = 0.9
Fig. 214A
PRICE
TON/DEP
Min. CST.
Mil. Rec.
Min Rec.
DILUTION
Roy. Cst.
Exp Cst.
Dev. Cst.
Cap. Cst.
I.R.R.
T/D

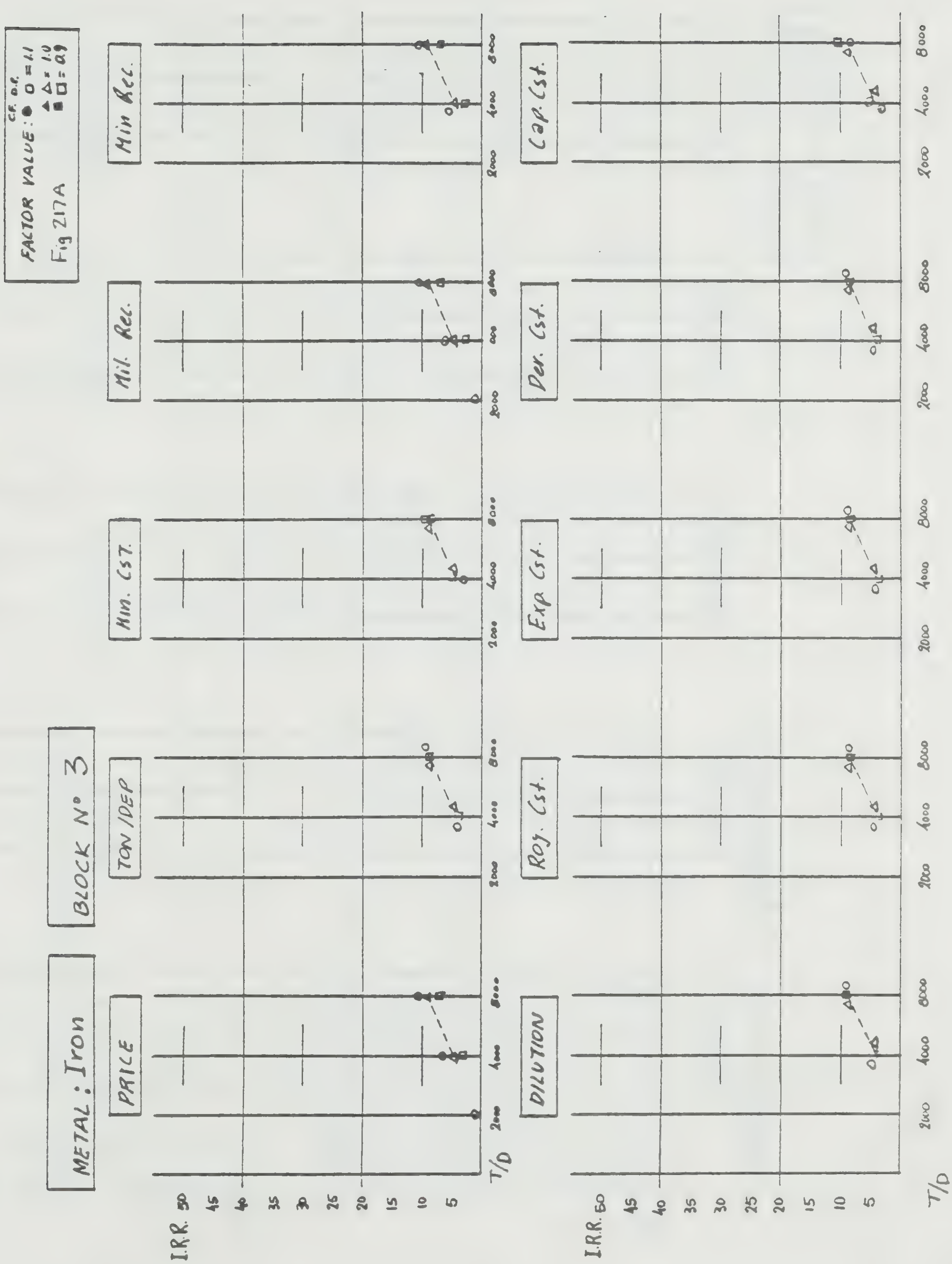

METAL : Silver
BLOCK N° 9
FACTOR VALUE : C.F. O.P. ● O = 1.1 ▲ Δ = 1.0 ■ □ = 0.9
Fig. 214B
GRADE
ENV. COST
TRAN. COST.
MIL. COST
I.R.R.
50 45 40 35 30 25 20 15 10 5
T/D
2000 4000 8000


FACTOR VALUE: C.R. O.R.
● ○ = 1.1
▲ △ = 1.0
■ □ = 0.9
Fig. 215A
METAL: Iron
BLOCK N° 1
PRICE
TON/DEP
Min. CST.
Mil. Rec.
Min Rec.
DILUTION
Roy. Cst.
Exp. Cst.
Dev. Cst.
Cap. Cst.
I.R.R.
50
45
40
35
30
25
20
15
10
5
T/D
2000
4000
8000

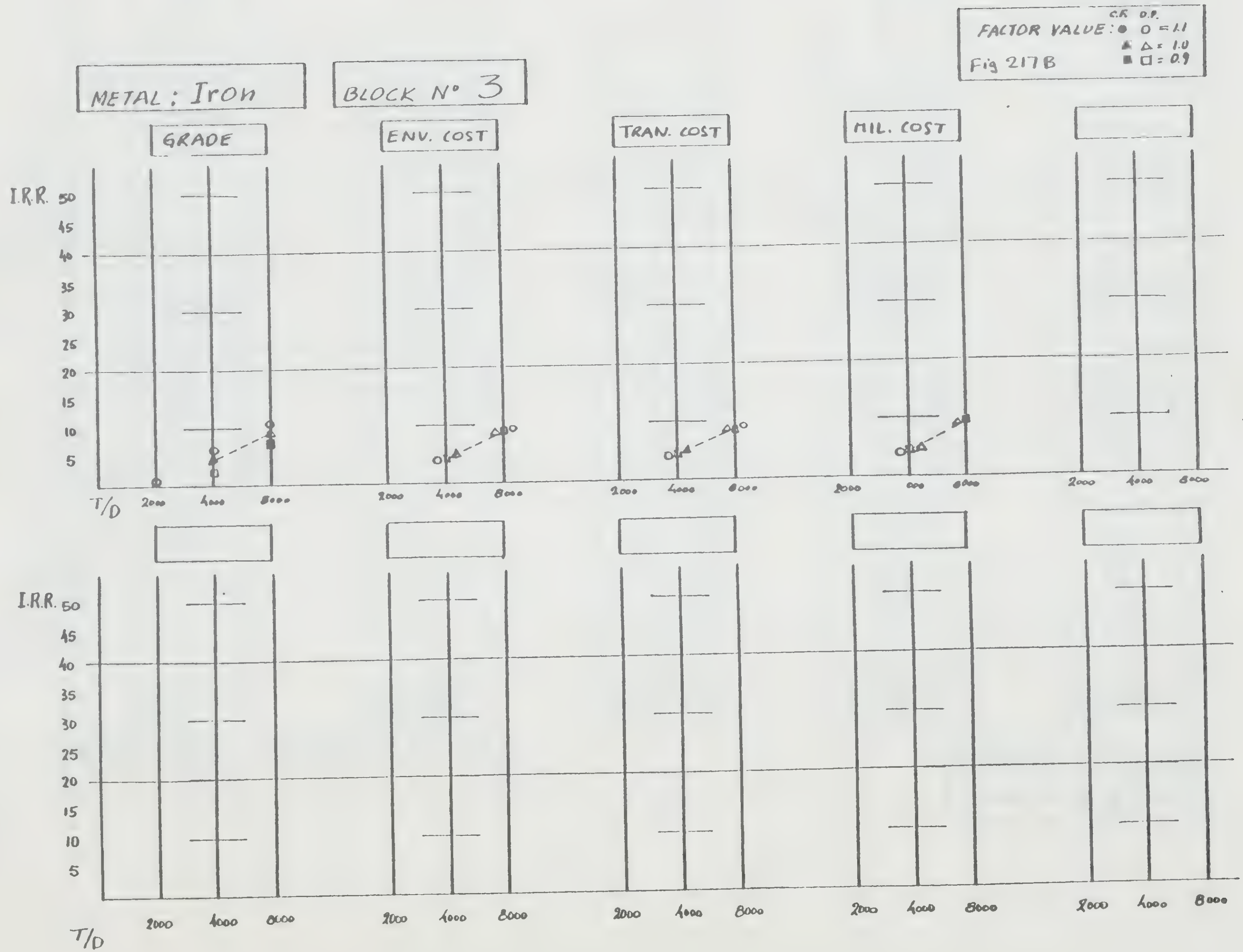

METAL: Iron
BLOCK Nº 1
FACTOR VALUE: ○ = 1.1 △ = 1.0 □ = 0.9
GRADE
ENV. COST
TRAN. COST
MIL. COST
I.R.R.
T/D

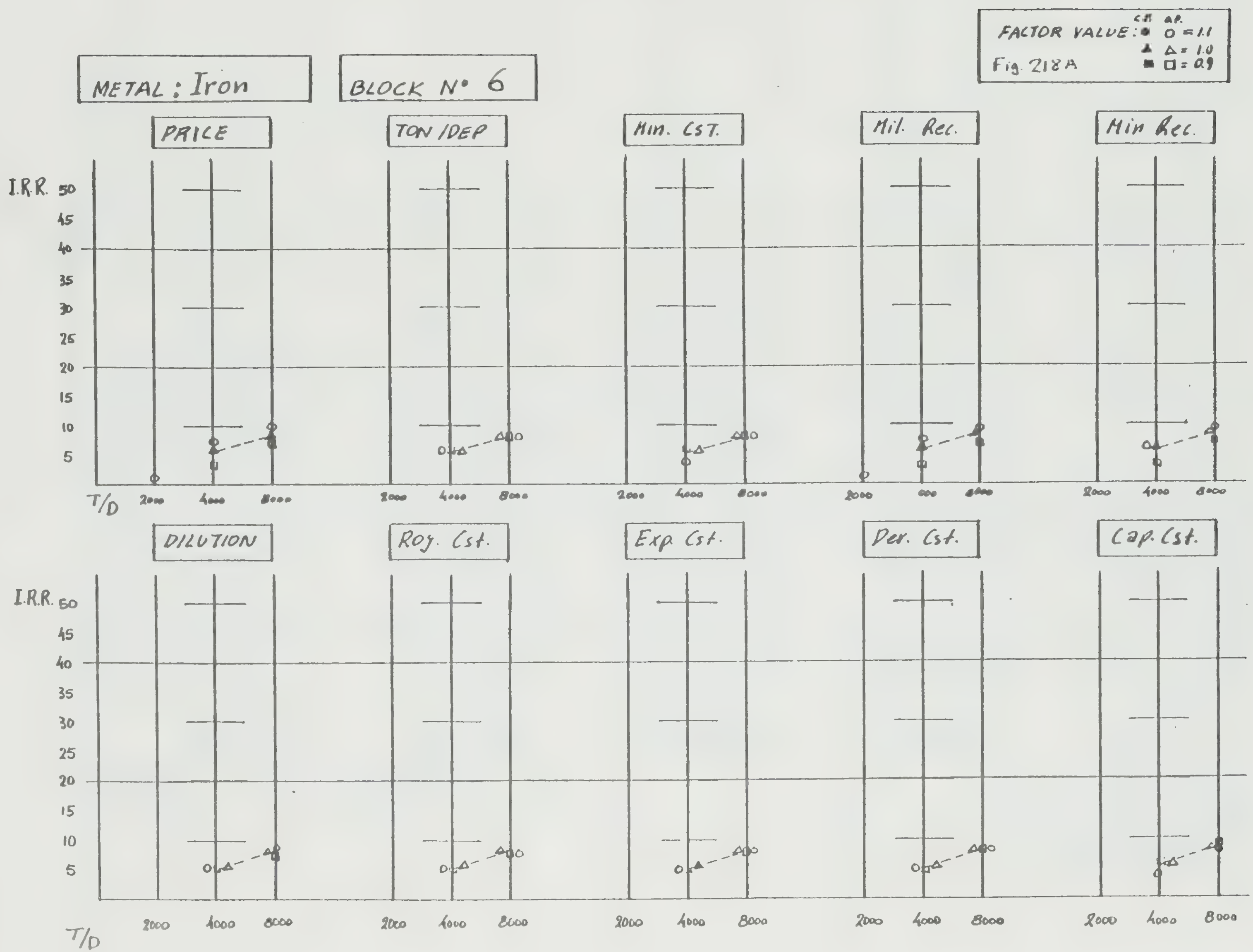

METAL : Iron
BLOCK N° 2
FACTOR VALUE: CE OP.
● ○ = 1.1
▲ △ = 1.0
■ □ = 0.9
Fig. 216 A
PRICE
TON/DEP
Min. CST.
Mil. Rec.
Min Rec.
DILUTION
Roy. Cst.
Exp Cst.
Dev. Cst.
Cap. Cst.
I.R.R.
50
45
40
35
30
25
20
15
10
5
T/D
2000
4000
8000

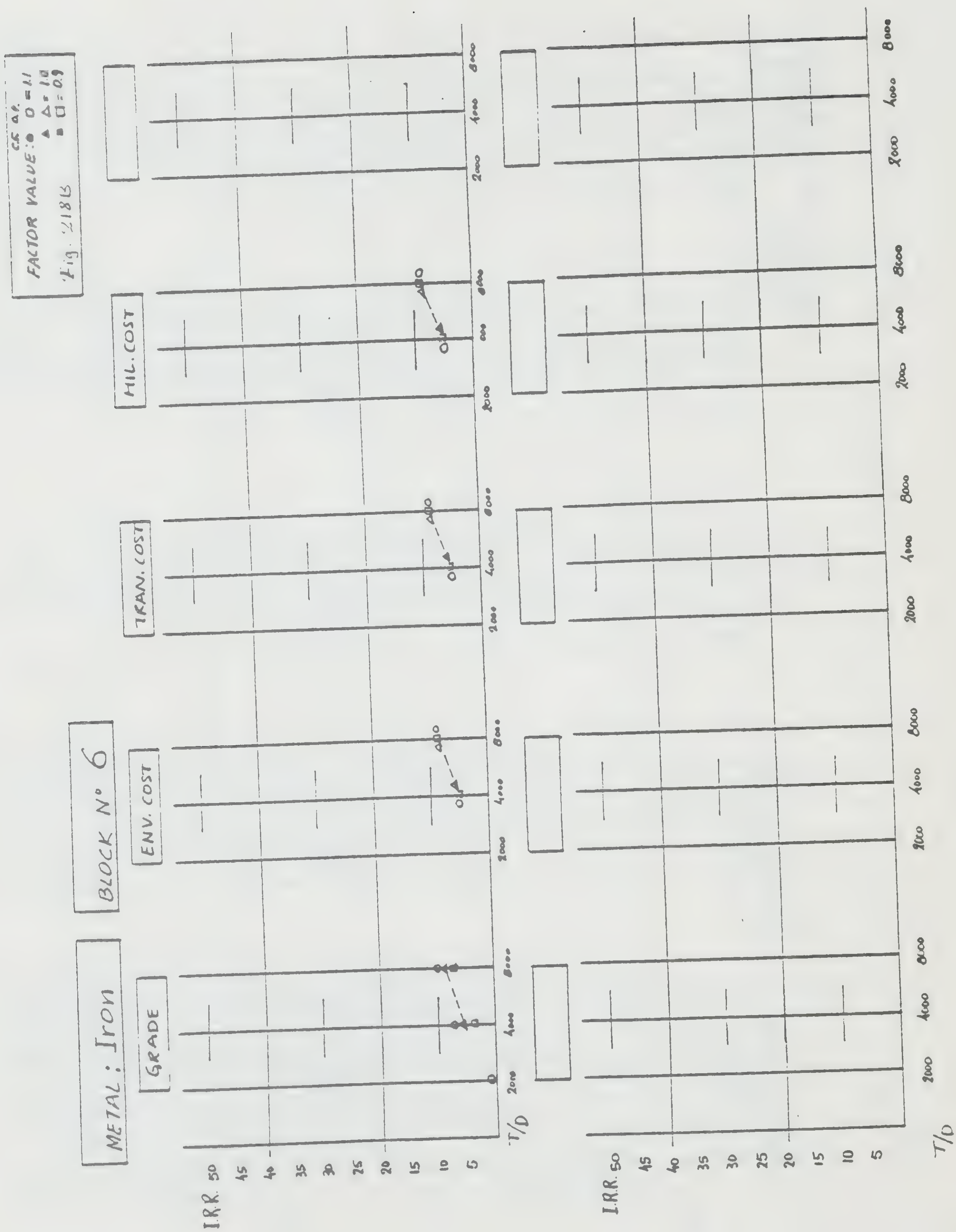

METAL : Iron
BLOCK N° 2
FACTOR VALUE : C.E ● ▲ ■ O.P. ○ = 1.1 △ = 1.0 □ = 0.9
GRADE
ENV. COST
TRAN. COST
MIL. COST
I.R.R.
50
45
40
35
30
25
20
15
10
5
T/D
2000
4000
8000

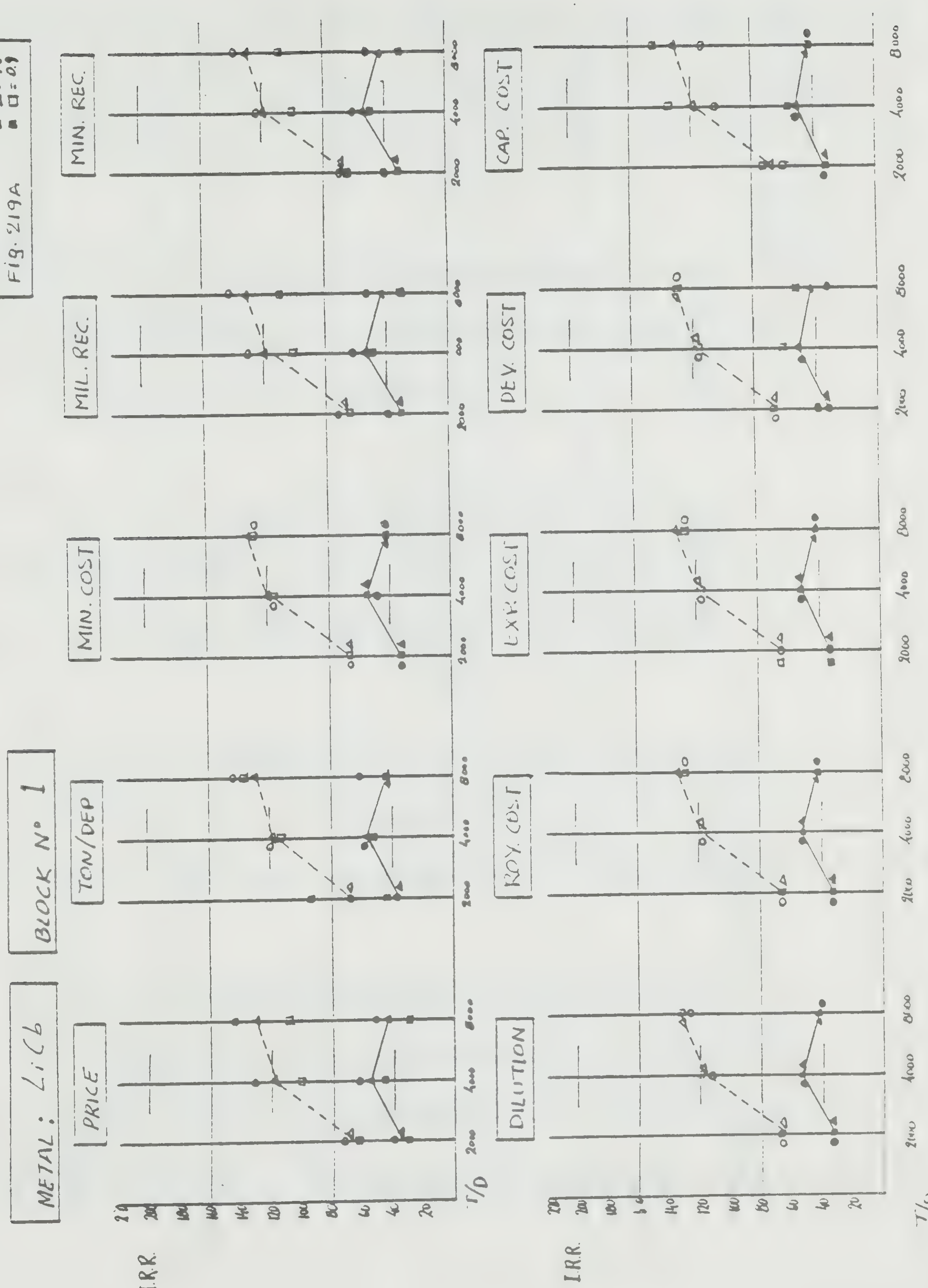


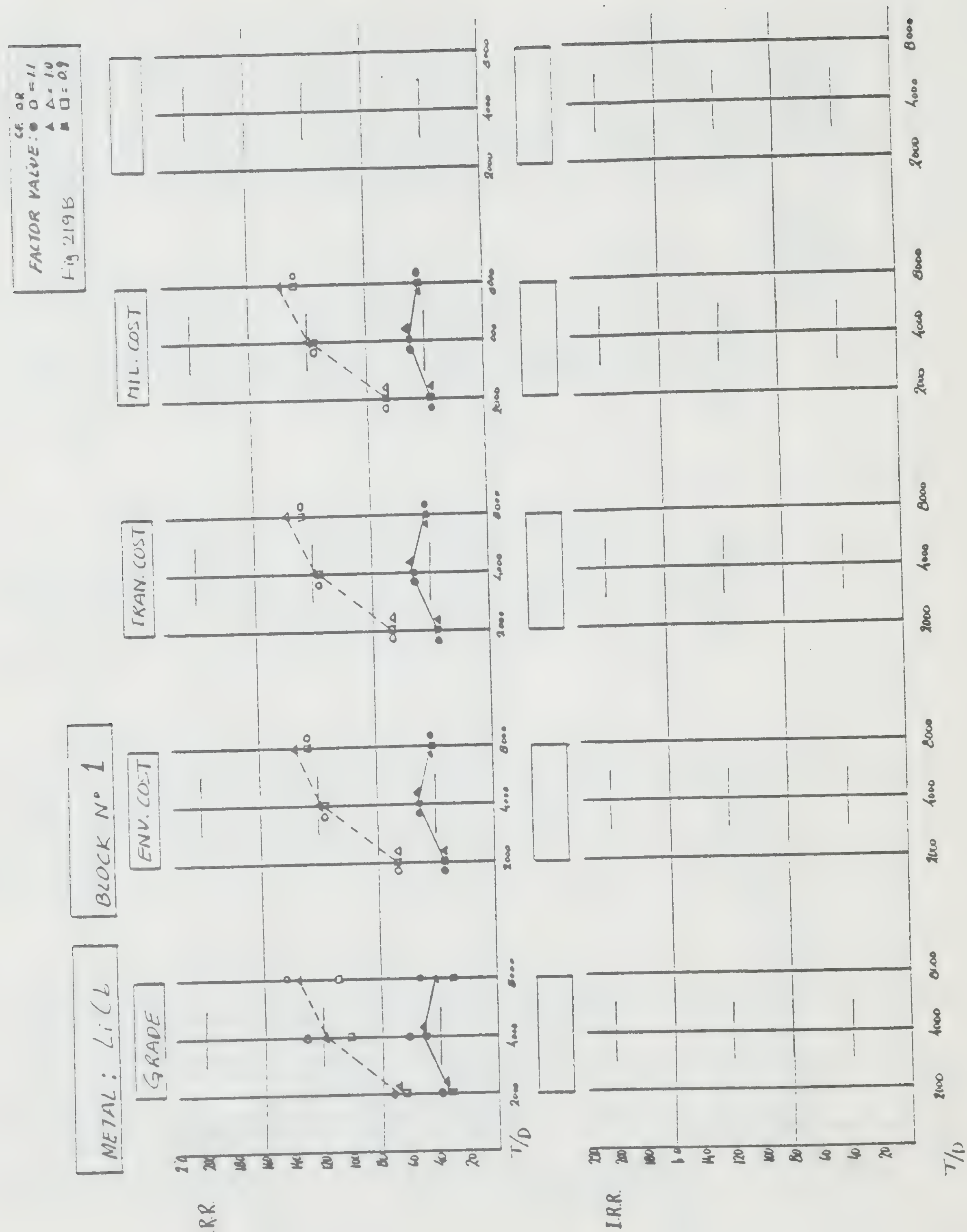
METAL: Iron
BLOCK N° 3
FACTOR VALUE: ● ○ = 1.1 ▲ △ = 1.0 ■ □ = 0.9
Fig 217A
PRICE
TON/DEP
Min. CST.
Mil. Rec.
Min Rec.
DILUTION
Roy. Cst.
Exp Cst.
Dev. Cst.
Cap. Cst.
I.R.R.
T/D

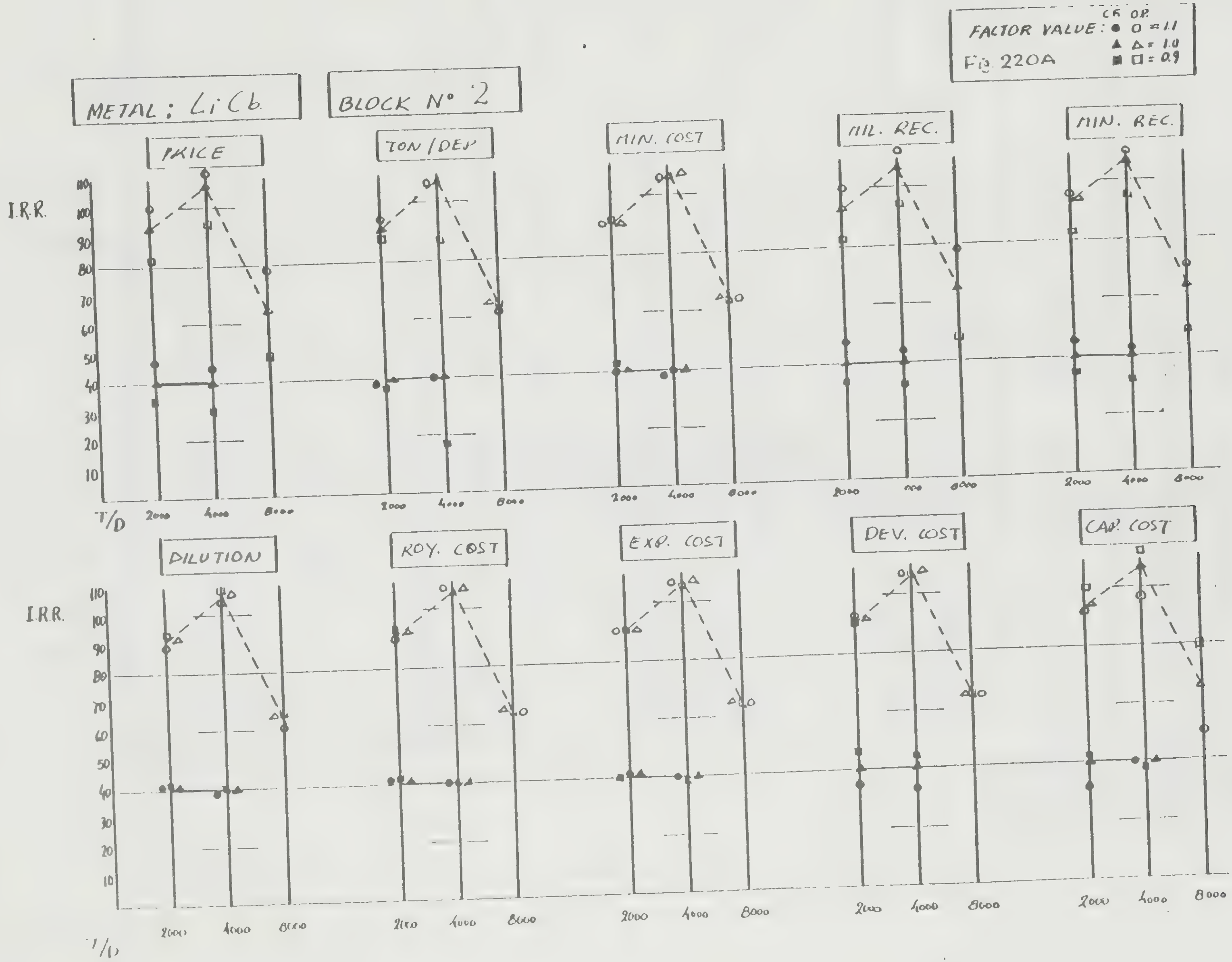

FACTOR VALUE: C.R. O.P. ● ○ = 1.1 ▲ △ = 1.0 ■ □ = 0.9
Fig 217B
METAL: Iron
BLOCK N° 3
GRADE
ENV. COST
TRAN. COST
MIL. COST
I.R.R.
50
45
40
35
30
25
20
15
10
5
T/D
2000
4000
8000

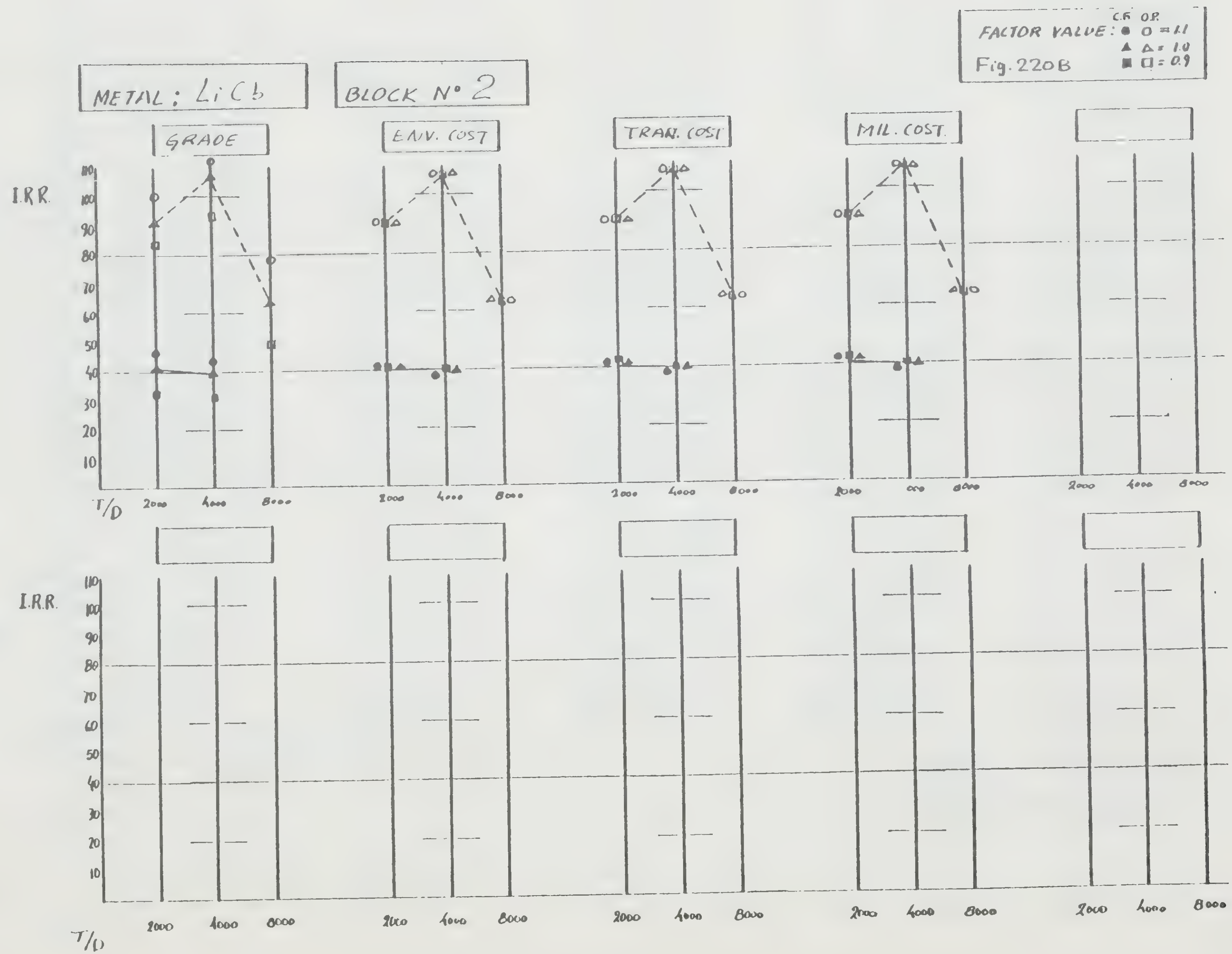

METAL : Iron
BLOCK N° 6
FACTOR VALUE: C.R. ● A.P. ○ = 1.1
▲ △ = 1.0
■ □ = 0.9
Fig. 218A
PRICE
TON / DEP
Min. CST.
Mil. Rec.
Min Rec.
DILUTION
Roy. Cst.
Exp Cst.
Der. Cst.
Cap. Cst.
I.R.R.
50
45
40
35
30
25
20
15
10
5
T/D
2000
4000
8000

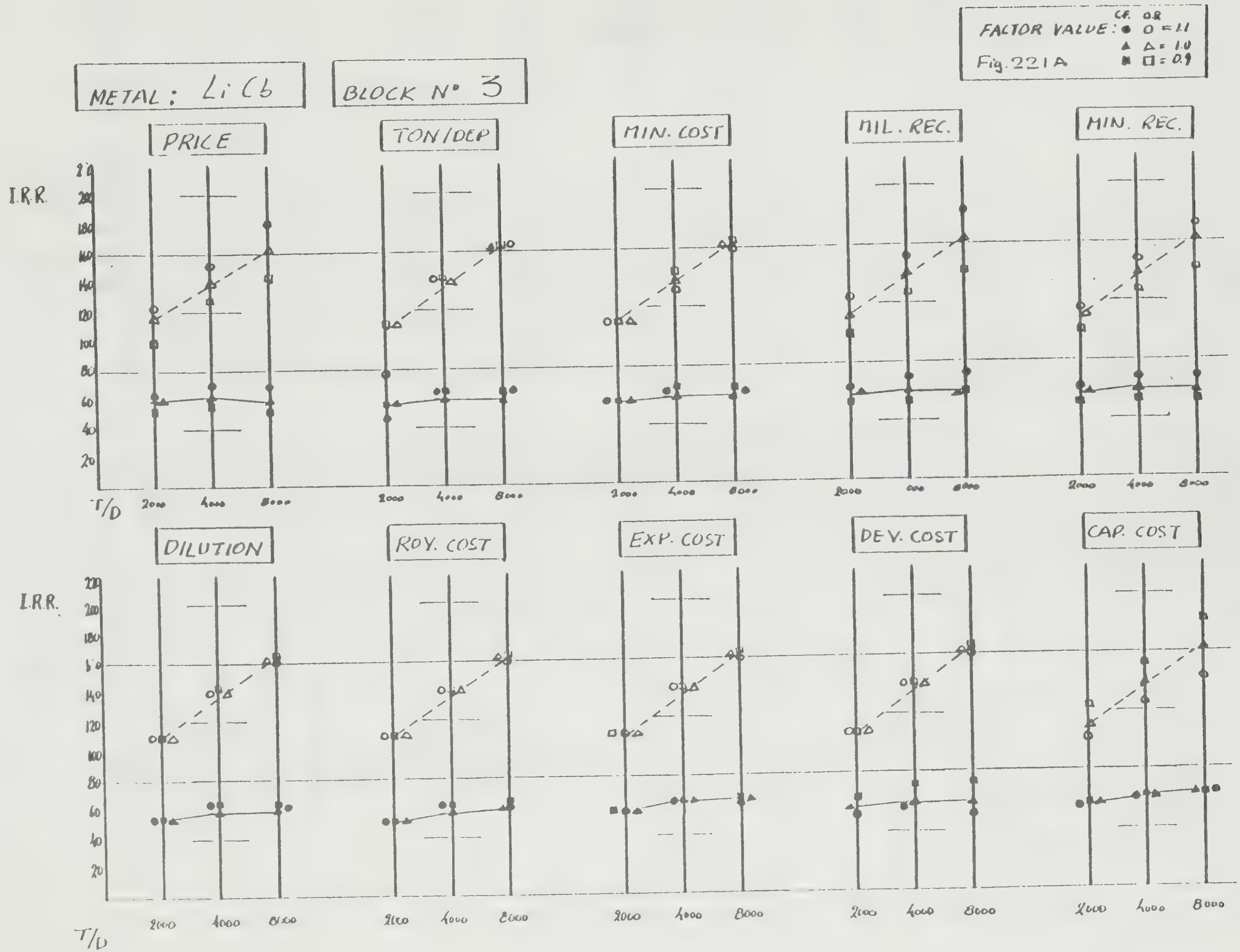

METAL: Iron
BLOCK N° 6
FACTOR VALUE: C.R. a.p. ○ = 1.1 △ = 1.0 □ = 0.9
Fig. 218B
GRADE
ENV. COST
TRAN. COST
MIL. COST
I.R.R.
T/D

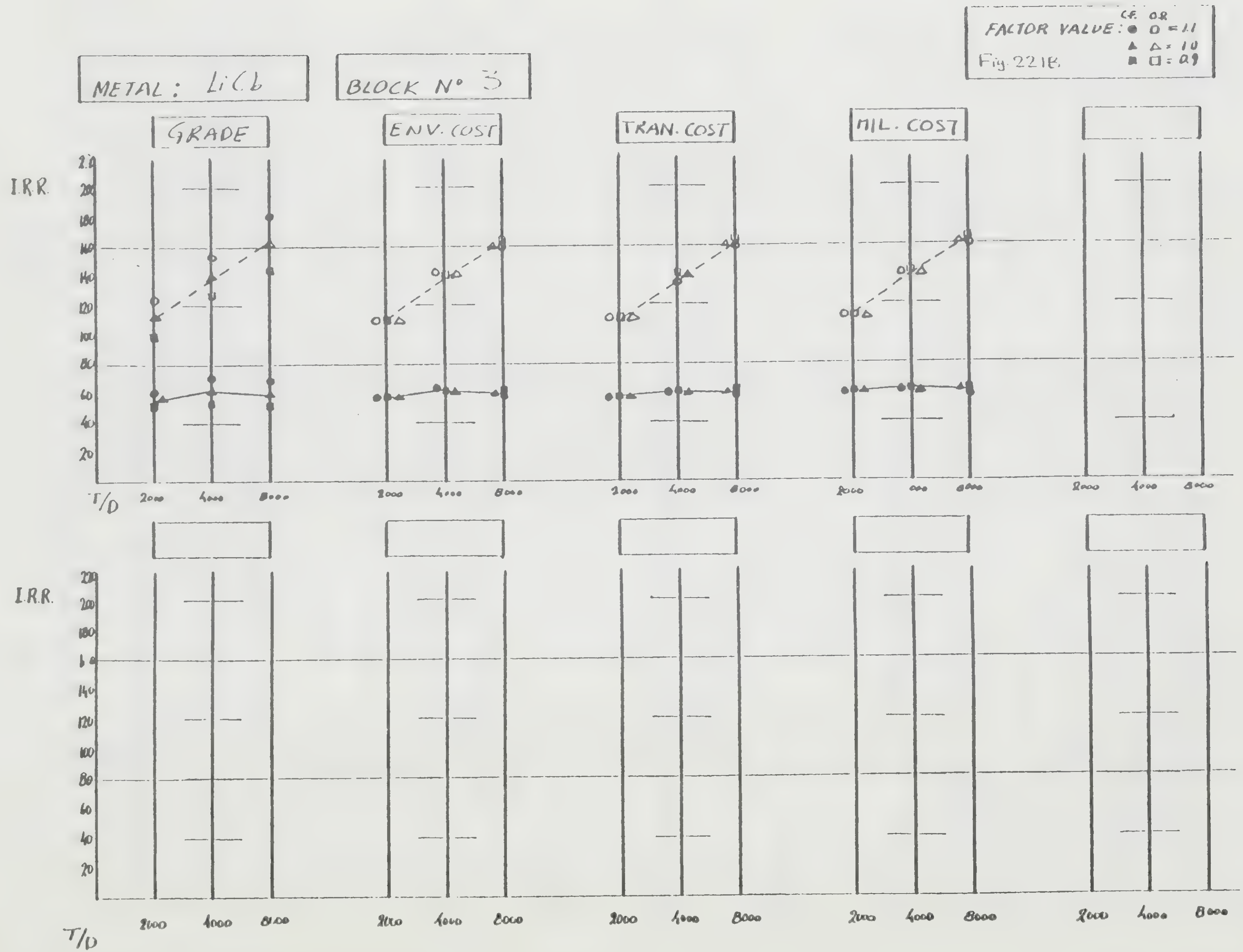

METAL : LiCb
BLOCK N° 1
FACTOR VALUE : ● O = 1.1 ▲ Δ = 1.0 ■ □ = 0.9
Fig. 219A
PRICE
TON/DEP
MIN. COST
MIL. REC.
MIN. REC.
DILUTION
ROY. COST
EXP. COST
DEV. COST
CAP. COST
I.R.R.
T/D

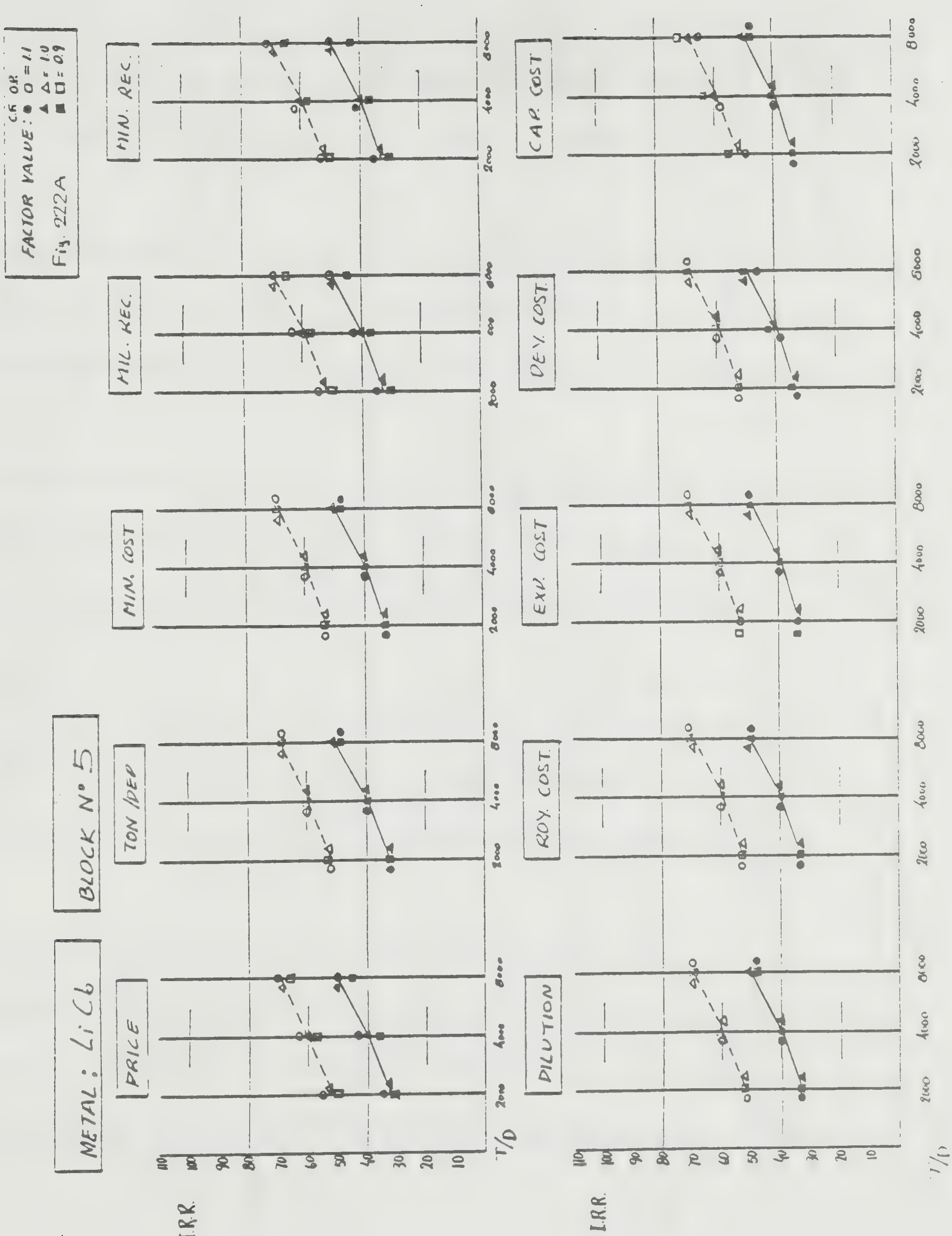

METAL: LiCl
BLOCK N° 1
FACTOR VALUE:
Fig 219B
GRADE
ENV. COST
TRAN. COST
MIL. COST
I.R.R.
T/D

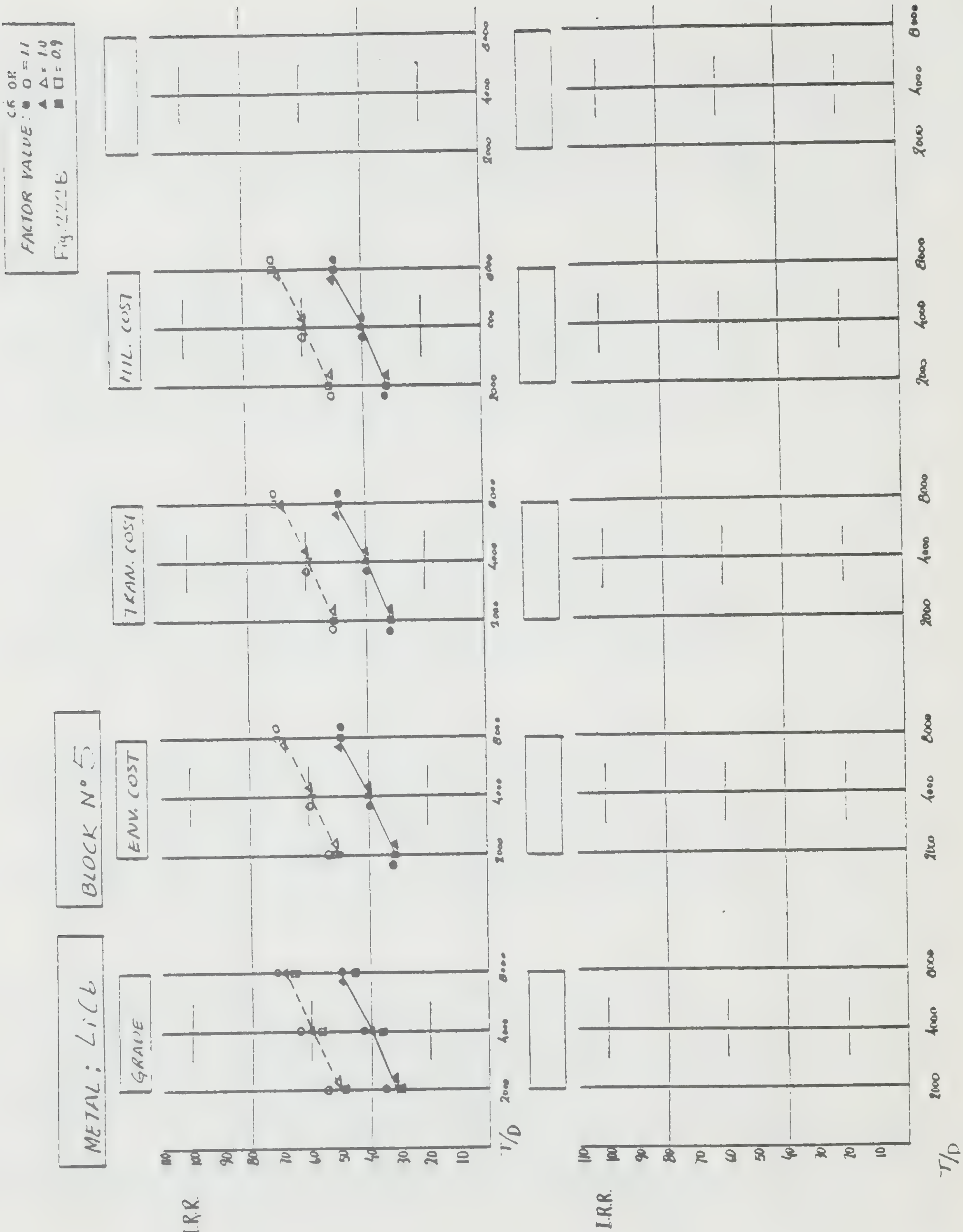

METAL: Li Cb.
BLOCK N° 2
FACTOR VALUE: CR ● OP. O = 1.1
▲ △ = 1.0
■ □ = 0.9
Fig. 220A
PRICE
TON/DEP
MIN. COST
MIL. REC.
MIN. REC.
DILUTION
ROY. COST
EXP. COST
DEV. COST
CAP. COST
I.R.R.
T/D
110
100
90
80
70
60
50
40
30
20
10
2000
4000
8000

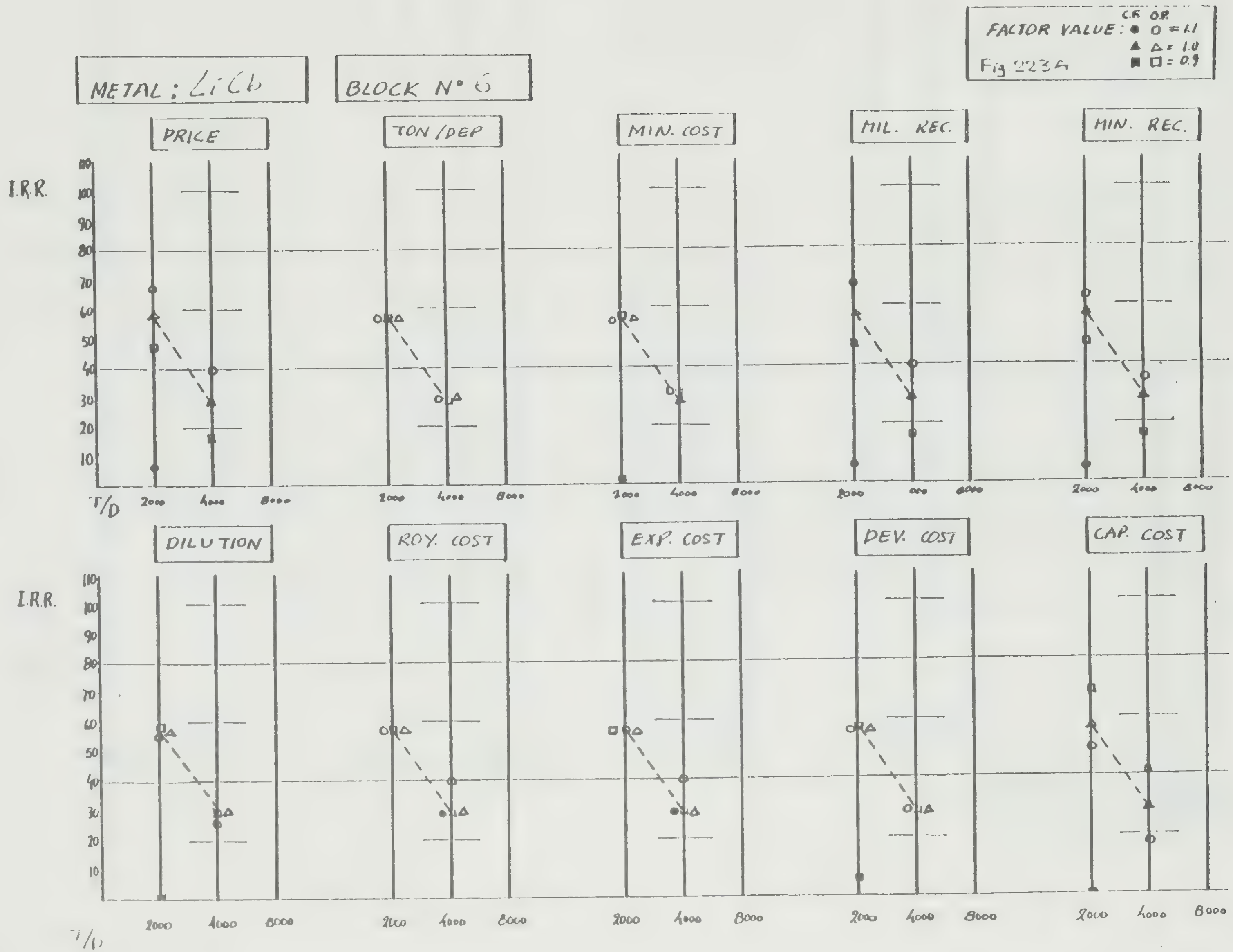

FACTOR VALUE: C.F. ● ▲ ■ O.P. O = 1.1 Δ = 1.0 □ = 0.9
Fig. 220B
METAL: LiCb
BLOCK N° 2
GRADE
ENV. COST
TRAN. COST
MIL. COST
I.R.R.
110
100
90
80
70
60
50
40
30
20
10
T/D
2000
4000
8000


FACTOR VALUE: CF. ● ▲ ■ OR ○ = 1.1 △ = 1.0 □ = 0.9
Fig. 221A
METAL: Li Cb
BLOCK N° 3
PRICE
TON/DEP
MIN. COST
MIL. REC.
MIN. REC.
DILUTION
ROY. COST
EXP. COST
DEV. COST
CAP. COST
I.R.R.
T/D
2000
4000
8000


METAL : LiCb
BLOCK N° 3
FACTOR VALUE: C.F. O.R.
● ○ = 1.1
▲ △ = 1.0
■ □ = 0.9
Fig. 221B.
GRADE
ENV. COST
TRAN. COST
MIL. COST
I.R.R.
T/D
2000
4000
8000


METAL: Li Cb
BLOCK N° 5
FACTOR VALUE: ● O = 1.1 ▲ Δ = 1.0 ■ □ = 0.9
Fig. 222A
PRICE
TON/DEP
MIN. COST
MIL. REC.
MIN. REC.
DILUTION
ROY. COST
EXP. COST
DEV. COST
CAP. COST
I.R.R.
T/D


BLOCK N° 5
FACTOR VALUE
CR OR
GRADE
ENV. COST
TRAN. COST
MIL. COST
I.R.R.
T/D


METAL : LiCb
BLOCK N° 6
FACTOR VALUE : C.F. OR.
● ○ = 1.1
▲ △ = 1.0
■ □ = 0.9
PRICE
TON/DEP
MIN. COST
MIL. REC.
MIN. REC.
DILUTION
ROY. COST
EXP. COST
DEV. COST
CAP. COST
I.R.R.
T/D
2000
4000
8000
10
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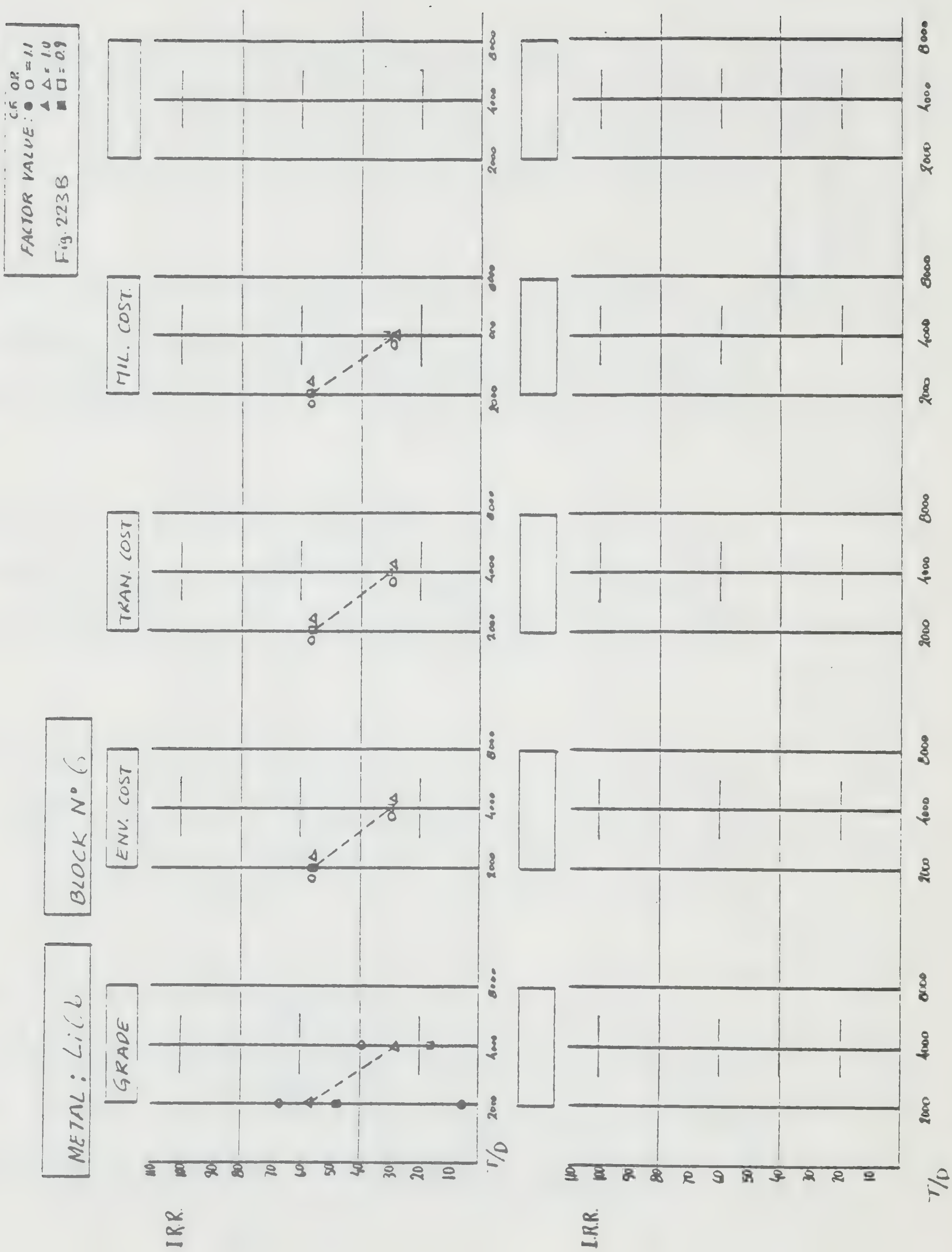
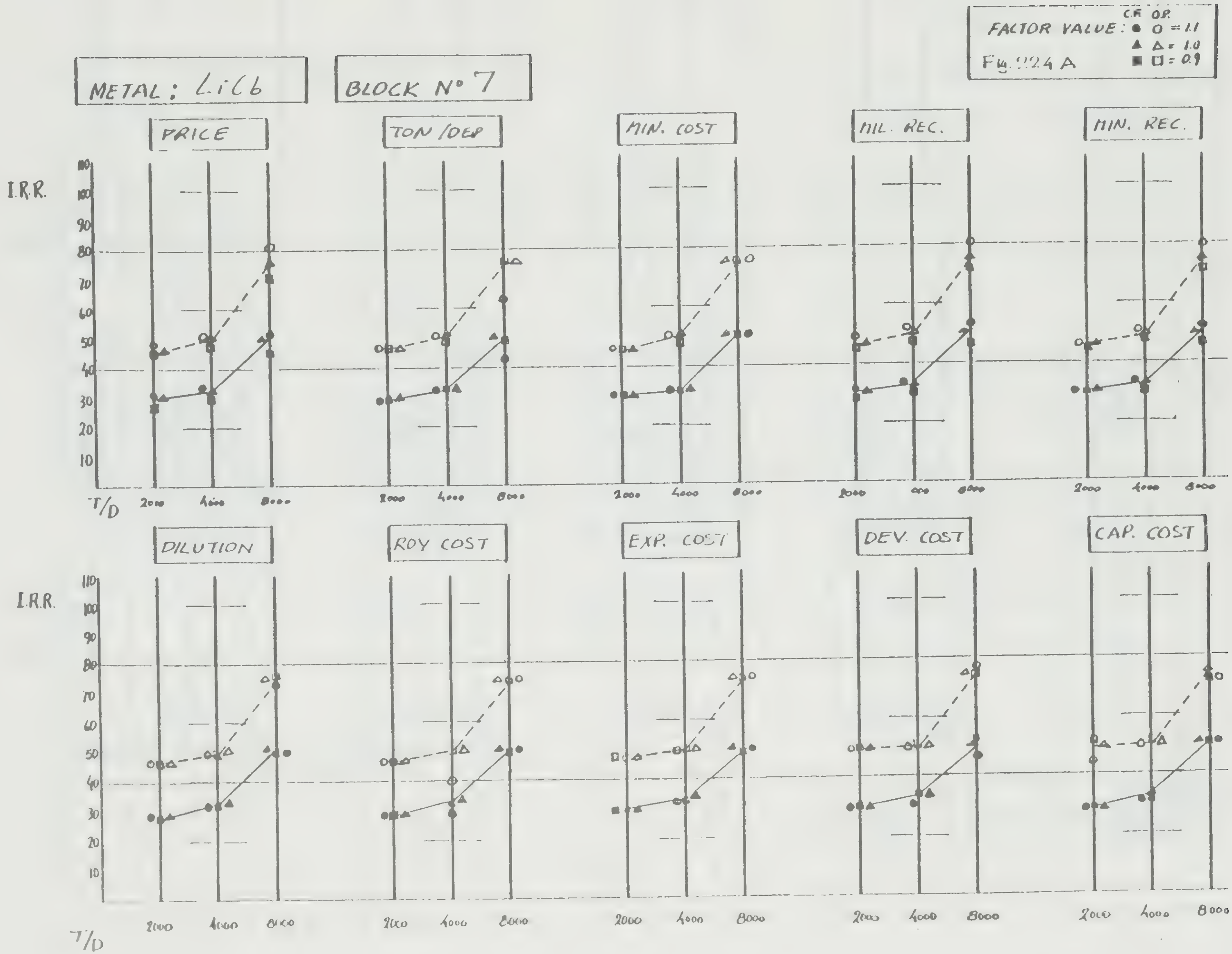
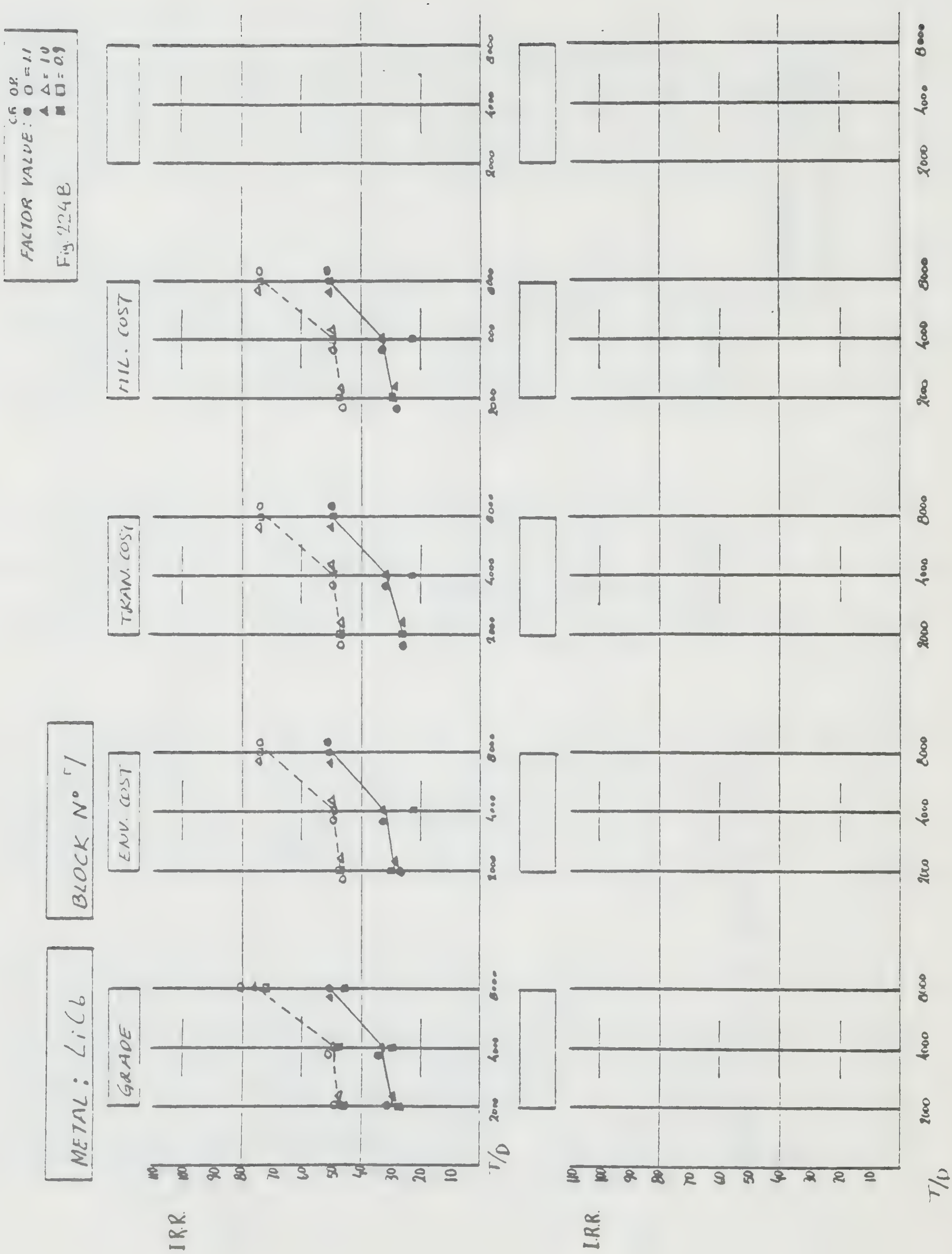
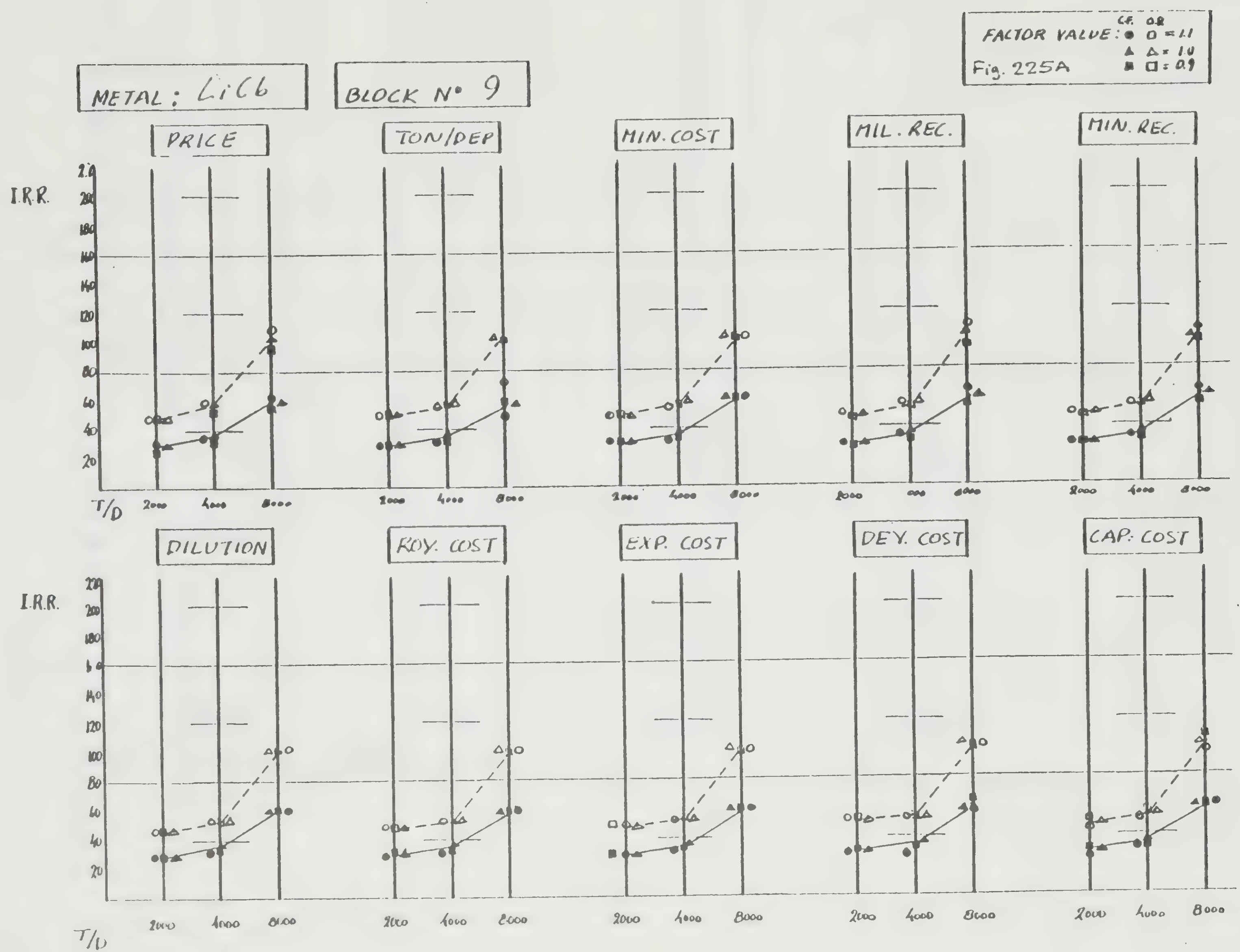
30
40
50
60
70
80
90
100
110
Fig. 223A

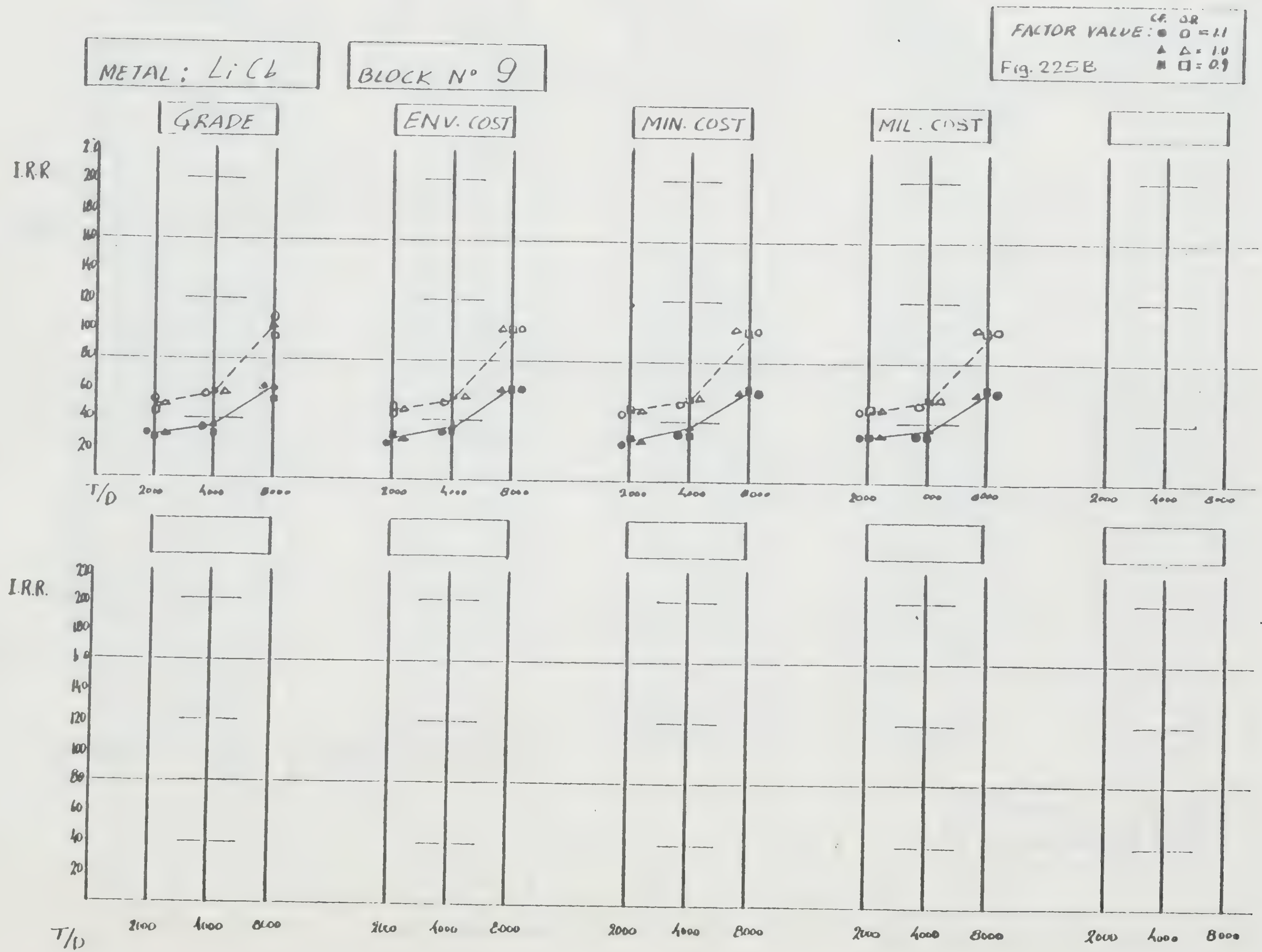

METAL:
BLOCK N° 6
FACTOR VALUE
Fig. 223B
GRADE
ENV. COST
TRAN. COST
MIL. COST
I.R.R.
T/D

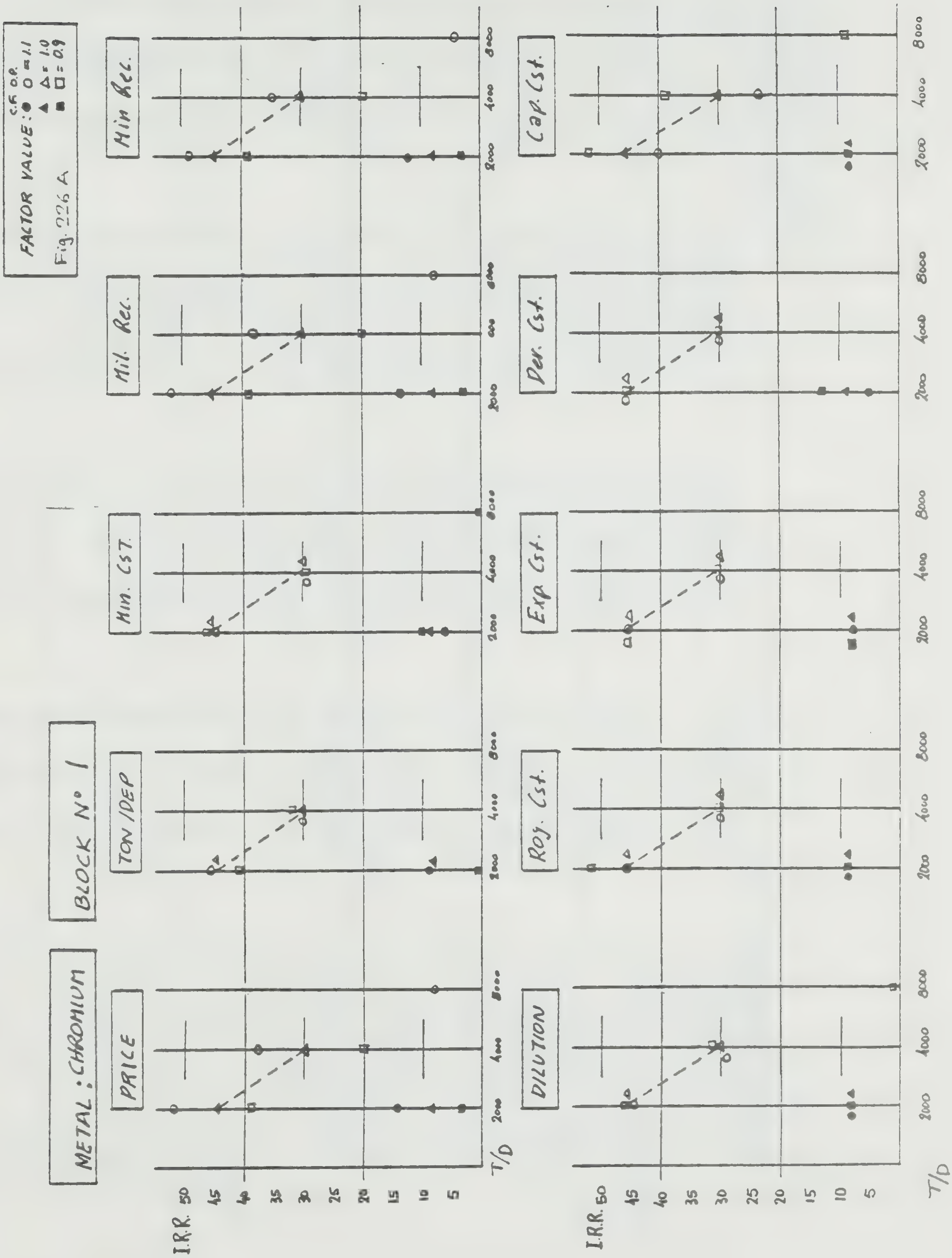

METAL: LiCb
BLOCK N° 7
FACTOR VALUE: C.F. ● ▲ ■ O.P. O = 1.1 Δ = 1.0 □ = 0.9
Fig. 224 A
PRICE
TON/DEP
MIN. COST
MIL. REC.
MIN. REC.
DILUTION
ROY COST
EXP. COST
DEV. COST
CAP. COST
I.R.R.
T/D
2000
4000
8000
10
20
30
40
50
60
70
80
90
100
110

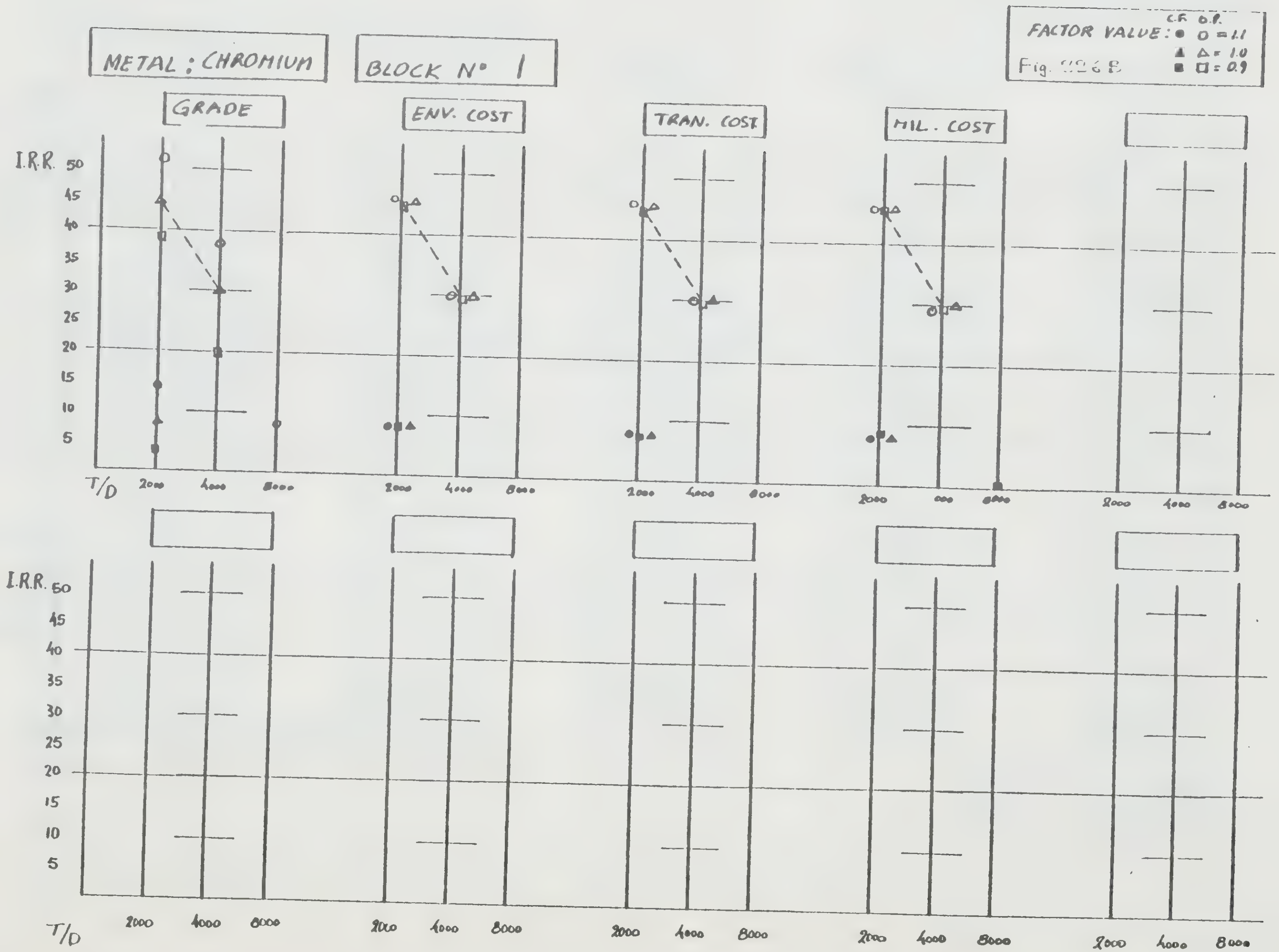


METAL: LiCb
BLOCK N° 7
FACTOR VALUE: C.R. OR. ● ○ = 1.1 ▲ △ = 1.0 ■ □ = 0.9
Fig. 224B
GRADE
ENV. COST
TRAN. COST
MIL. COST
I.R.R.
T/D

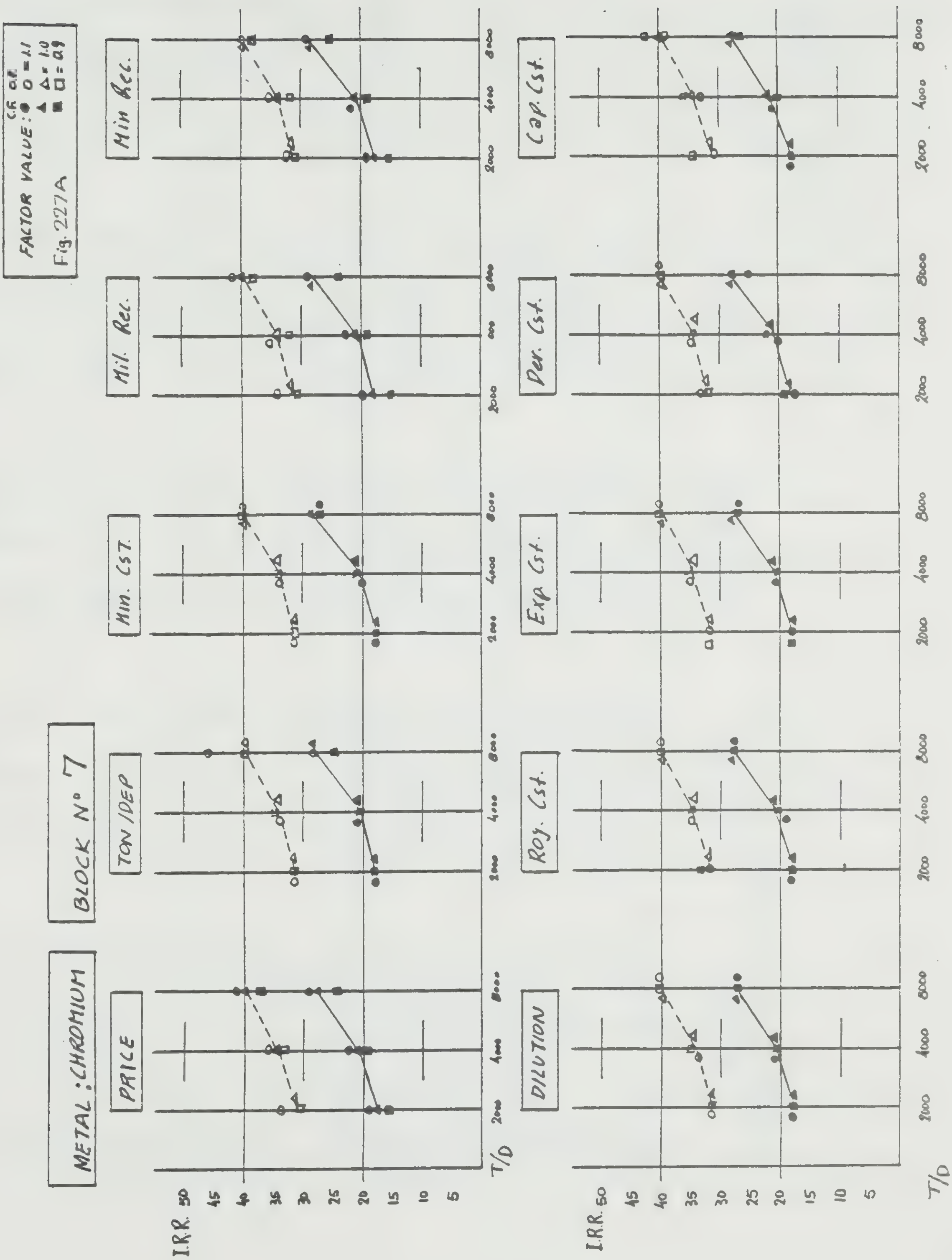

METAL : LiCb
BLOCK N° 9
FACTOR VALUE: ● ○ = 1.1
▲ △ = 1.0
■ □ = 0.9
C.F. 0.8
Fig. 225A
PRICE
TON/DEP
MIN. COST
MIL. REC.
MIN. REC.
DILUTION
ROY. COST
EXP. COST
DEV. COST
CAP. COST
I.R.R.
T/D
2000
4000
8000

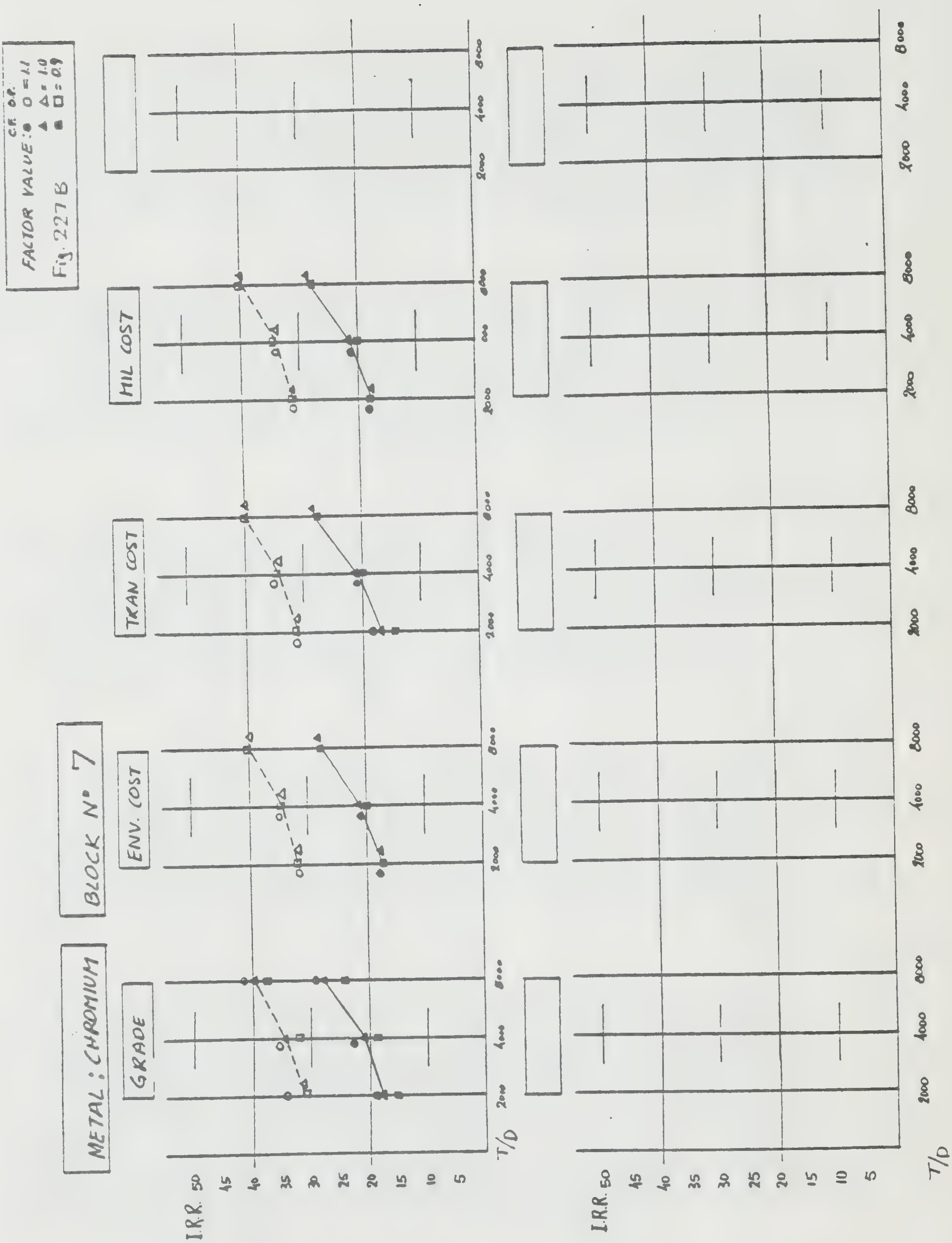

METAL: LiCl
BLOCK N° 9
FACTOR VALUE: CF. OR
● ○ = 1.1
▲ △ = 1.0
■ □ = 0.9
Fig. 225B
GRADE
ENV. COST
MIN. COST
MIL. COST
I.R.R
T/D
2000
4000
8000

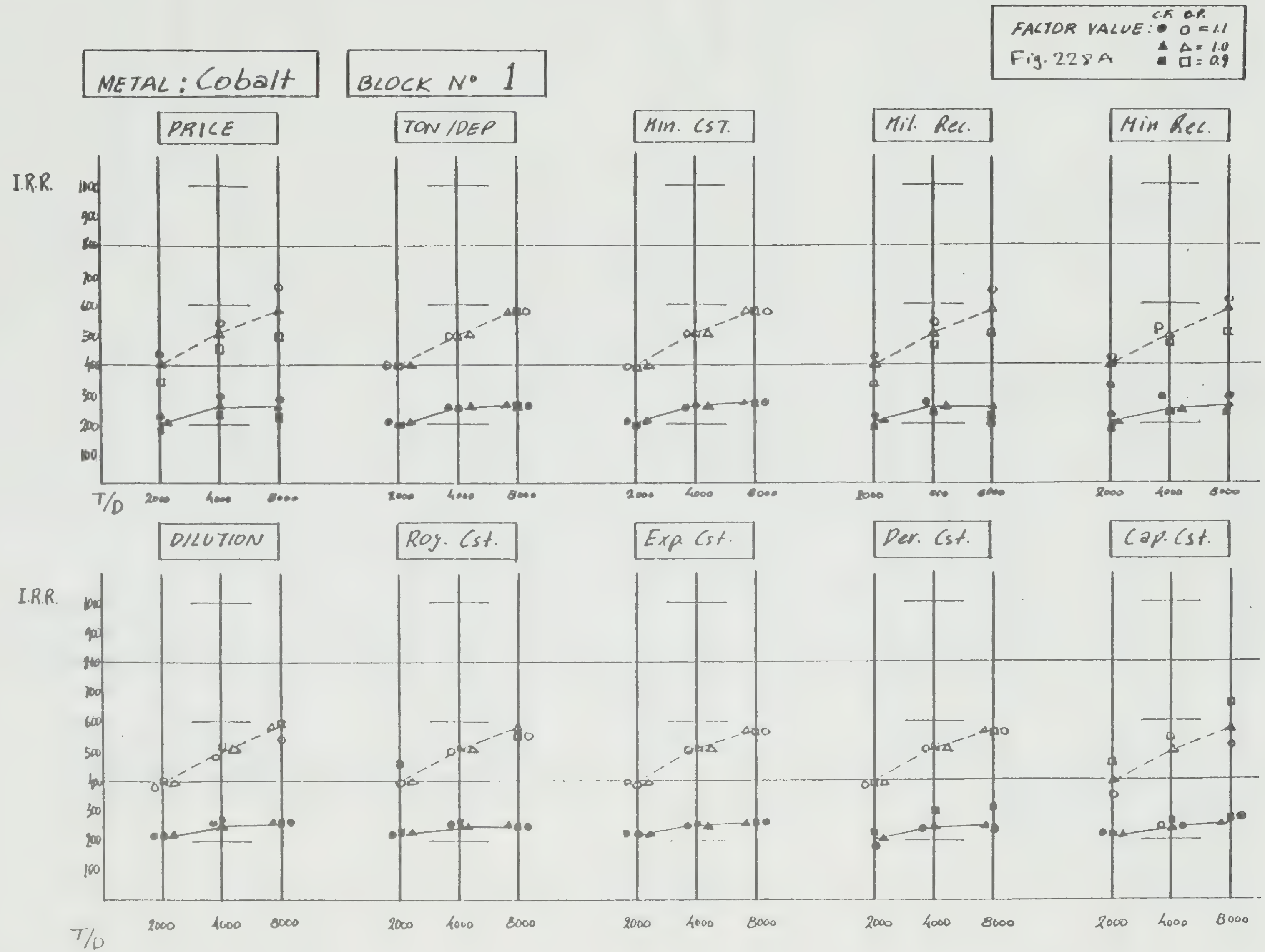

METAL : CHROMIUM
BLOCK N° 1
FACTOR VALUE:
Fig. 226 A
PRICE
TON/DEP
Min. CST.
Mil. Rec.
Min Rec.
DILUTION
Roy. Cst.
Exp Cst.
Dev. Cst.
Cap. Cst.
I.R.R.
T/D

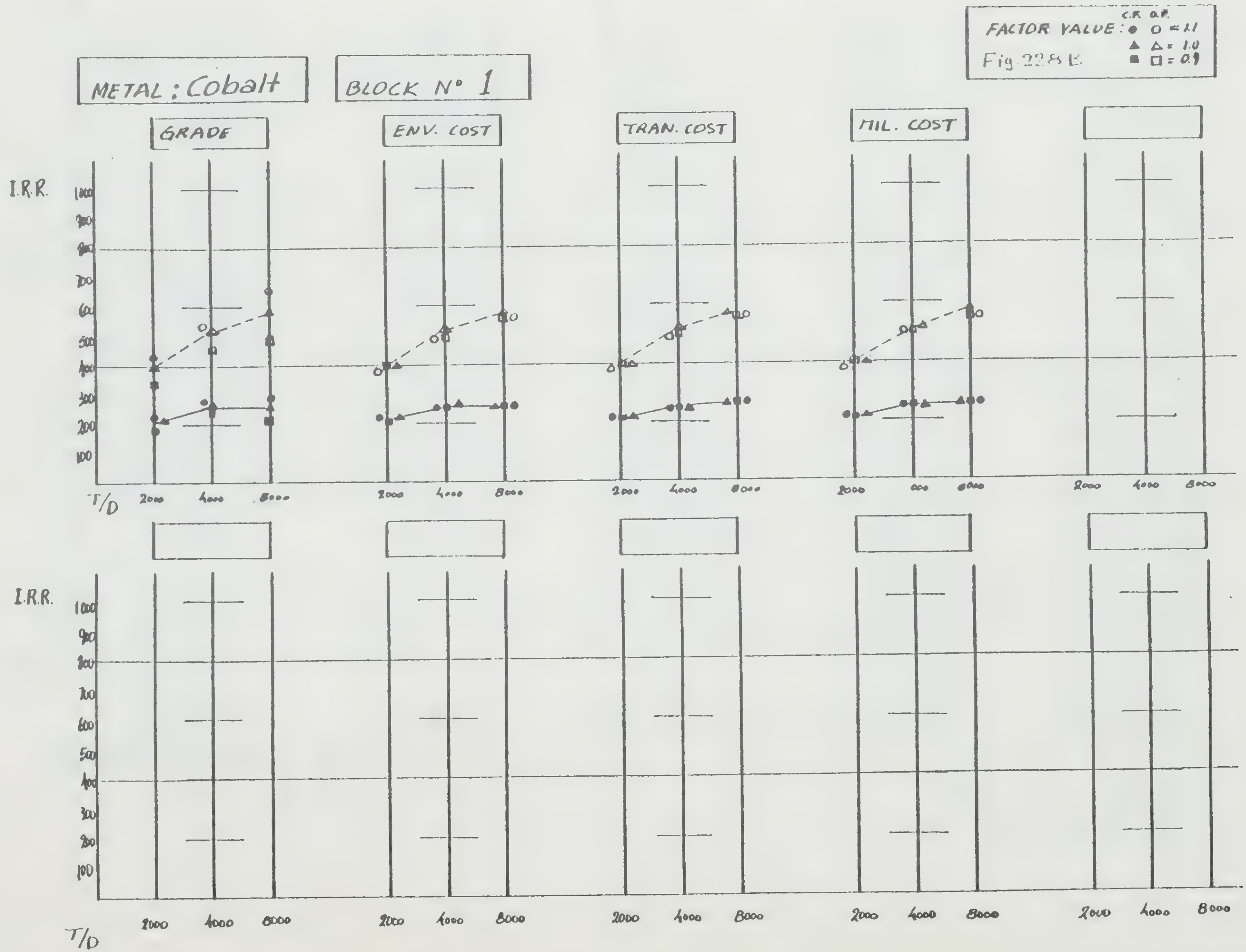


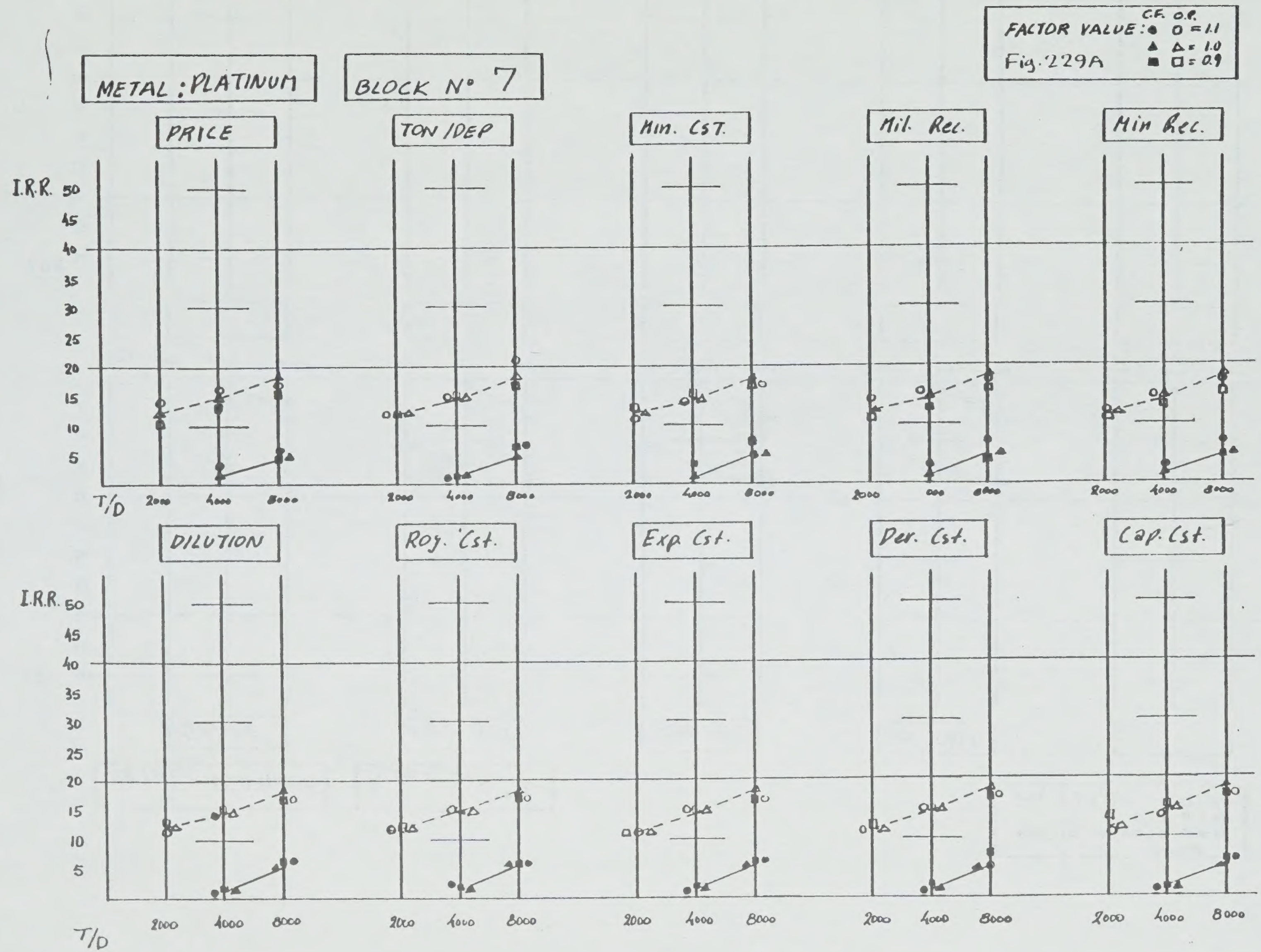
METAL : CHROMIUM
BLOCK N° 1
FACTOR VALUE: C.F. O.P. ● ○ = 1.1 ▲ △ = 1.0 ■ □ = 0.9
GRADE
ENV. COST
TRAN. COST
MIL. COST
I.R.R.
50
45
40
35
30
25
20
15
10
5
T/D
2000
4000
8000


METAL: CHROMIUM
BLOCK N° 7
FACTOR VALUE: C.R. O.R. ● ○ = 1.1 ▲ △ = 1.0 ■ □ = 0.9
Fig. 227A
PRICE
TON/DEP
Min. Cst.
Mil. Rec.
Min Rec.
DILUTION
Roy. Cst.
Exp Cst.
Per. Cst.
Cap. Cst.
I.R.R.
T/D

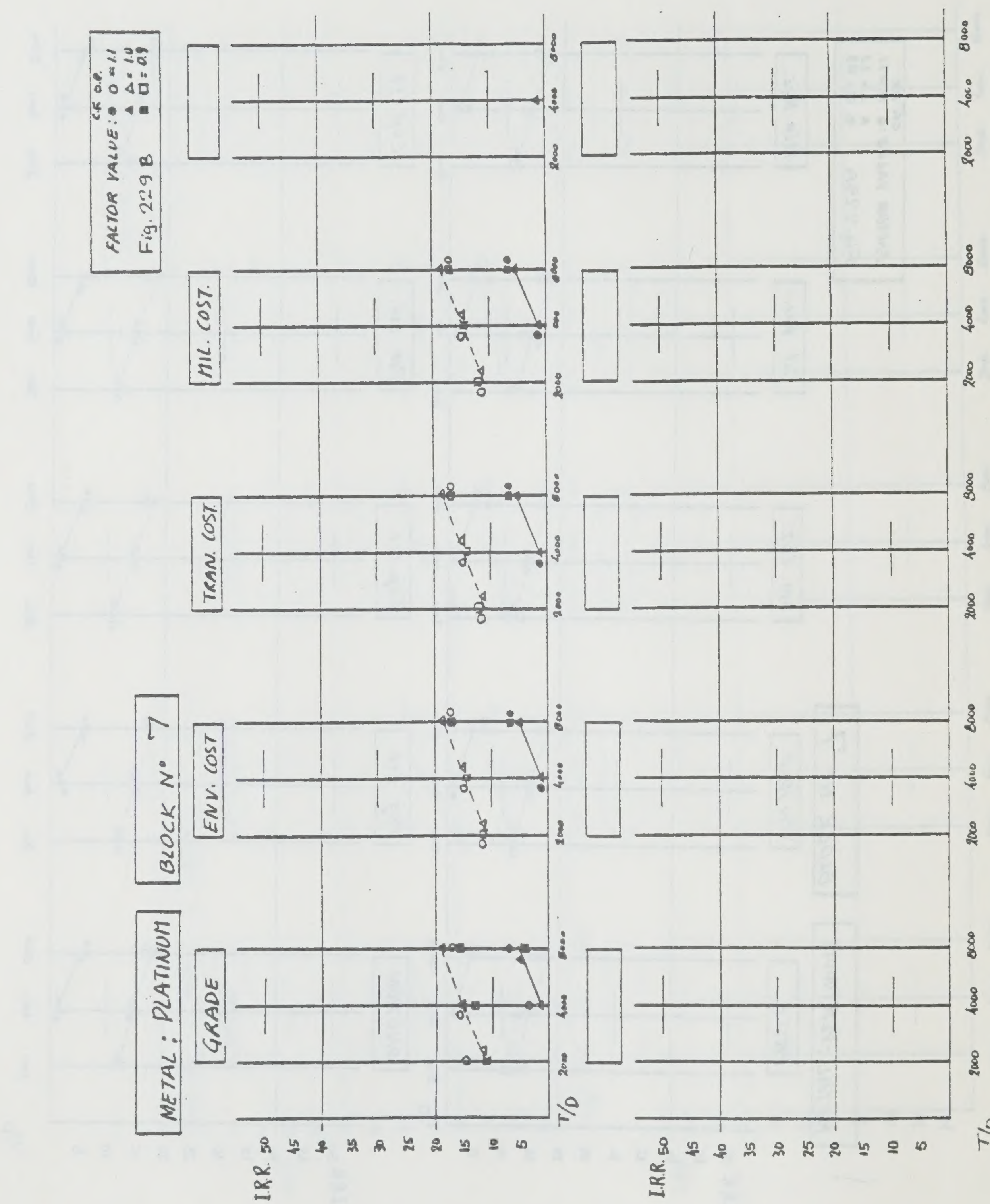

METAL : CHROMIUM
BLOCK N° 7
FACTOR VALUE : C.F. O.P.
● ○ = 1.1
▲ △ = 1.0
■ □ = 0.9
Fig. 227 B
GRADE
ENV. COST
TRAN COST
MIL COST
I.R.R.
T/D
2000
4000
8000
50
45
40
35
30
25
20
15
10
5


METAL : Cobalt
BLOCK N° 1
FACTOR VALUE: C.F. ● ▲ ■ O.P. ○ = 1.1 △ = 1.0 □ = 0.9
Fig. 228A
PRICE
TON/DEP
Min. CST.
Mil. Rec.
Min Rec.
DILUTION
Roy. Cst.
Exp Cst.
Der. Cst.
Cap. Cst.
I.R.R.
T/D
2000
4000
8000


METAL: Cobalt
BLOCK N° 1
FACTOR VALUE: C.F. O.P. ● O = 1.1 ▲ △ = 1.0 ■ □ = 0.9
Fig. 228 E
GRADE
ENV. COST
TRAN. COST
MIL. COST
I.R.R.
1000 900 800 700 600 500 400 300 200 100
T/D
2000 4000 8000



METAL : PLATINUM
BLOCK N° 7
FACTOR VALUE : C.F. O.P. ● ○ = 1.1 ▲ △ = 1.0 ■ □ = 0.9
Fig. 229A
PRICE
TON/DEP
Min. CST.
Mil. Rec.
Min Rec.
DILUTION
Roy. Cst.
Exp Cst.
Der. Cst.
Cap. Cst.
I.R.R.
50
45
40
35
30
25
20
15
10
5
T/D
2000
4000
8000



METAL : PLATINUM
BLOCK N° 7
FACTOR VALUE: C.R. O.P. ● ○ = 1.1 ▲ △ = 1.0 ■ □ = 0.9
Fig. 229 B
GRADE
ENV. COST
TRAN. COST.
MIL. COST.
I.R.R.
T/D